RD & W 2004

- 2 SEP 1988
EXCHANGE
GENERAL LIBRARY

TRANSACTIONS
of
THE NORFOLK & NORWICH NATURALISTS' SOCIETY

Vol. 28 Part 1 August 1988

TRANSACTIONS OF THE NORFOLK AND NORWICH NATURALISTS' SOCIETY

ISSN 0375 7226 Volume 28 Part 1 (August 1988) Editor A. G. Irwin

OFFICERS OF THE SOCIETY 1987-1988

President: T. B. Terry

Vice-Presidents: P. R. Banham, A. L. Bull, K. B. Clarke, E. T. Daniels, D. A. Dorling, K. C. Durrant, R. Jones, Mrs J. Robinson, M. J. Seago, J. A. Steers, E. L. Swann, F. J. Taylor-Page

Chairman: K. C. Durrant, 18 The Avenue, Sheringham
Secretary: A. L. Bull, "Hillcrest", East Tuddenham, Dereham NR20 3JJ
Asst. Secretary: Mrs J. Negal, "Inishmore", Newton Flotman
Treasurer: D. A. Dorling, 6 New Road, Hethersett, Norwich NR9 3HH
Asst. Treasurer: M. J. Woolner, 45 Gurney Road, Norwich NR5 0HH
Membership Committee: R. Hancy (*Chairman*), C. Dack (*Secretary*)
Programme Committee: R. Robinson (*Chairman*), Miss D. Robinson (*Secretary*)
Publications Committee: R. Jones (*Chairman*), Dr A. G. Irwin, M. J. Seago, R. Hancy
Research Committee: P. R. Banham (*Chairman*), A. J. Parr (*Secretary*)
Hon. Auditor: J. E. Timbers, The Nook, Barford.

Elected Members of Council:
(Retiring 1988) F. Farrow, A. Johnson, A. Scowen, Miss R. Walby
(Retiring 1989) D. A. Fagg, J. G. Goldsmith, Mrs P. Hardie, M. Poulton
(Retiring 1990) Mrs M. Cooper, E. Cross, N. Gibbons, M. Smith
Co-opted and Representative Members of Council:
Dr Irwin (*Museum*) serves as an officer: Dr W. Sutherland (*University*)
R. Hobbs (*Norfolk Naturalists Trust*), P. Wright (*Nature Conservancy Council*)

SPECIALISTS AND ORGANISERS OF SPECIALIST GROUPS

Birds (Editor of the Report):
M. J. Seago, 33 Acacia Road, Thorpe St Andrew, Norwich NR7 0PP
Mammals (Editor of the Report):
R. Hancy, 124 Fakenham Road, Taverham NR8 6QH
Bats: J. G. Goldsmith, Castle Museum, Norwich NR1 3JU
Amphibia & Reptiles: J. Buckley, 22 Aurania Avenue, Norwich
Higher Plants: A. L. Bull, "Hillcrest", East Tuddenham, Dereham (East Norfolk)
Mrs G. Beckett, Bramley Cottage, Stanhoe, King's Lynn PE31 8QF (West Norfolk)
Mosses & Liverworts: C. R. Stevenson, 111 Wootton Road, King's Lynn
Algae: K. B. Clarke, Decoy House, Browston, Great Yarmouth
Fungi: R. E. Evans, "Chanterelle", Church Road, Welborne, Dereham
Insects: K. C. Durrant, 18 The Avenue, Sheringham NR26 8DG
Mollusca: R. E. Baker, 25 Southern Reach, Mulbarton NR14 8BU
Marine: P. R. Banham, Field Study Centre, Polka Road, Wells-next-the-Sea
Freshwater: R. J. Driscoll, Castle Museum, Norwich NR1 3JU
Photography: R. Robinson, 5 Southern Reach, Mulbarton NR14 8BU

FRONT COVER: The shore crab *Carcinus maenas* — a common saltmarsh inhabitant *(R. E. Jones)*

LEARNING THROUGH NATURE

THE PRESIDENTIAL ADDRESS DELIVERED TO THE SOCIETY ON 27 JANUARY 1988

T. B Terry

11a Newfound Drive, Cringleford, Norwich.

Ladies and Gentlemen-

When you did me the honour of inviting me to become your President, I thought that you would wish me to address you on a topic related to my involvement in Norfolk education, both as a Biology teacher at Wymondham College, and subsequently as the Education Committee's Schools Science Adviser. Taken together, these appointments spanned some twenty-seven years, and it is about some of the experiences, and the perceptions developed from them while working with Norfolk children and teachers in the field of Environmental Education, that I wish to speak to you this evening.

I feel sure that if I were addressing you as a retired teacher, whose whole professional life had been devoted to the classroom, rather than as a retired Local Education Authority Adviser, I would tell you about somewhat different, but not necessarily unrelated things. Certainly, what you can achieve as a teacher is fairly obvious to yourself and to others. To a degree, it is measurable. As an Adviser, you must touch the minds and lives of children through help and guidance to their teachers. This process demands a fair measure of tact and patience, and it lacks much of the reward which attends day to day contact with children, whatever their age. On the other hand, it gives you the privilege of serving large numbers of children and teachers, and by seeing them at work in a variety of schools, gives perspective to your judgement. You come to see more clearly those things which can be achieved, how they can be achieved, and when is the right time to achieve them.

For teachers who are able to excite their pupils' interest in the natural world, and go on to consolidate it into lasting knowledge, I have the utmost admiration. It is a humbling experience to share a lesson with a gifted teacher, knowing that you would be hard pressed indeed to match the performance. On the other hand, it is through such experiences that you perceive the possible, and are able to think of ways of helping others.

If we accept that, for their educational and personal development, it is right for children to study living things from the time they enter school until the time they leave, then which qualities do their teachers need? Answers, of course, may vary according to the age and aptitude of the children taught, but there is enough common ground for a few generalisations.

Basically, teachers need to have an awareness of, and a natural affinity with, the plants and animals around them, and a concern for their well being. Ideally, their knowledge of them should be at least adequate, and there should be a willingness to augment it as opportunity and time permit. These teachers should be good managers, with clear aims for what they are teaching, and well defined objectives for their students' learning. At the same time, they need to be sufficiently flexible in outlook, so that advantage can be taken of the many unplanned events which characterise any study of the living world.

Having thus generalised, it is perhaps salutary to look at the situation which exists in Infant and Junior classes. Teachers here are expected to teach most subjects, and relatively few will have had specialist training in Natural Science, and in that I would include Nature Study. It is therefore not altogether surprising that

Trans. Norfolk Norwich Nat. Soc.
1988 **28**(1), 1-10.

many classrooms reflect this state of affairs, and where a teacher makes a special contribution to the study of plants and animals, it stands out.

Training apart, another factor which has to be taken into account is a lack of enthusiasm on the part of some teachers, for natural history. This is perfectly understandable, but taken together with lack of training, it does mean that many children are denied the joys and stimulation which come from first-hand experience of studying living things. It can be said, of course, that as long as there are one or two teachers in a school who are enthusiasts, then most children will pass through their classes at some stage or other. Thankfully, they probably would do so, but it has to be remembered that concepts are developed slowly, and children need to have experience throughout each stage of development.

It is not my wish to over-emphasise the difficulties which beset the teaching of Natural Science, but rather to point out that they exist, and that they present special problems to both teachers and advisers. In my own case, with Environmental Education being but a part of my overall job description, and with over five hundred schools to visit, it took much time and patience to effect any significant change. Things did improve later on, when I was joined by a colleague about whom it is difficult to speak too highly. Alan Sandford, who sadly died in 1986, will be remembered for his tireless efforts to improve the quality of Science Education, and for planning many of the changes inherent in schools going Comprehensive. His help made it possible for me to undertake a number of developments in the Primary phase which otherwise would not have occurred.

Certainly, outside agencies were always willing to help with in-service training, and over the years valuable assistance was given by the Staff of Keswick College of Education, now the School of Education at the University of East Anglia. Their contributions were always practical and down to earth, and a number of Norfolk teachers will always be grateful to them. But there again, in terms of the total need, the overall impact was necessarily limited.

During the 1960's and 1970's there were several National initiatives, the aims of which were to help teachers develop work in Natural Science. Chief amongst these were the Nuffield Junior Science Project and the Schools Council 5/13 Science Project, the latter being rather more structured in its approach. Both Projects produced much material, offering new ideas, ways of implementing them in the classroom, and suggestions for appropriate resources. All this was badly needed, and it gave Advisers a firm foundation on which in-service training could be based.

The Local Authority was particularly generous in funding resources, and the resulting programme of in-service training was considerable. However, in the main, classroom results did not live up to initial expectations, and the reasons for this were fairly clear. Hardworking non-specialsts, already teaching across the curriculum, found the breadth of subject matter difficult to put into practice.

With this experience in mind, it was decided to investigate more fully the circumstances prevailing in our own classrooms, and to see what could be achieved at a more limited level. The specialist Adviser for First and Primary Schools, Margaret Linton, expressed her willingness to help, and it seemed reasonable to start at the beginning—in other words, with teachers of 5-7 year olds.

As it happened, the re-organisation of local government had recently taken place, and the former Great Yarmouth County Borough Education Department was now a part of the administrative county of Norfolk. This seemed a good place to start, as it would give us opportunities to meet and get to know new colleagues. As time

permitted over a period of several months, we visited the classroom of every Infant and First School teacher in Great Yarmouth, Gorleston, and the nearby villages, assessing the kinds of activities which were taking place which could be related to Natural Science. This included the use of appropriate B.B.C. and I.T.V. television programmes.

It became clear that there was one thing, and one thing only, which was common to most classrooms, and that was a display of natural objects which some teachers still chose to call the Nature Table. It must be said, however, that many displays were very limited, both in their content and use. But it was at least a start and we felt that with some research on our part, we could find ways to use classroom collections more profitably. Ideas fed into the schools during short courses and our visits, were subsequently tested by individual teachers and then, by further courses and visits, disseminated to the remainder. As the project grew, so did the confidence of the teachers, and we reached a stage where we could claim that there was a viable and often stimulating Nature Table in every classroom. That was the beginning.

As the work progressed, it was realised that the study of living things could be greatly helped if it was linked to language development, an aspect of learning to which, like Mathematics, all teachers are committed. The implementation of this policy increased the confidence of the teachers, as they could see that the study of nature was, at one and the same time, advancing the language skills of their children.

For your own understanding of the situation, the following scenario might be helpful.

Imagine a class of six year olds, grouped around a Nature Table, with their teacher sitting at one end of it. On the table are numerous specimens, and along the front is a double row of hessian pockets, each pocket marked with a letter of the alphabet and containing a variety of one-word labels. The words—nouns and adjectives—relate to the specimens which are, or have been, on the Nature Table. Thus pocket 'S' for example, might contain cards with words like 'shells', 'sharp', 'smooth', 'soil', 'snail', 'seeds', 'stem', 'snowdrops' etc. The cards themselves are large, so that the printed word can be seen from a distance.

The following are just a few examples of the activities which the children might undertake:

1. Appropriate labels are found and placed against each specimen. In the case of adjectives, considerable discussion and observation can take place before the most suitable word is selected. Sometimes the teacher may need to introduce a new word, and another label is made.
2. A duplicate set of labels is used for word to word matching. The labels are removed from the table and a child is challenged to see if he/she can replace them correctly. The labels are 'posted' back into the correct pockets.
3. Teacher and children look through all the words in the pockets. The children are asked to select words which could relate to a given topic—e.g. trees. Reasons must be given for their choice. They are then asked to decide if any of the selected words could be placed on that particular Nature Table. Again, reasons must be given.

For young children these are stimulating and exacting tasks, and the teacher needs to grade their difficulty in line with the conceptual and language development of each child. Through such activities, children's mastery of vocabulary improves as their power of observation develops, and slowly but surely their acquaintance with the variety of things in the world around them increases. They are indeed learning through nature!

As we observed children acquiring and using new words, our thoughts naturally turned to reading materials, and we soon realised that there were very few books, at the right reading level, which could be used in connection with the unfolding Nature Table work. We carried out a survey of 112 Infant reference/information books which were available at that time, with the following results:

Reading age:	*Number of books:*
5-5½	0
5½-6	0
6-6½	21
6½-7	22
7-7½	32
7½-8	37

These confirmed our classroom observations, and particularly emphasised the need for more books for beginners—i.e. children with reading ages between 5 and 6+. We knew what was needed—books with clear print, simple descriptive language, and large bold illustrations which would in themselves give clues to the text. We envisaged the illustrations as portraying specimens commonly found on Nature Tables at different times of the year.

Knowing the kind of books which were needed, we produced a prototype version, had it tested in the classroom, and sought a publisher. In due course, twelve titles were published, together with a teachers' guide, under the overall title of the

Nature Table Series. Teachers now had an additional resource, and reading became another facet of learning through Nature.

In our work with these young children, it was always fascinating to note the interaction between observation and language. This is interesting at any level, and for much older students the following is a worthwhile and entertaining exercise—and one which you, yourselves, could do.

Working in pairs, six different flowering grasses are picked, and without recourse to botanical terms—other than those in everyday use such as 'stem', 'leaf' etc.—each grass is described in writing, on separate pieces of paper numbered one to six. The descriptions should be couched in the simplest possible language, and arrived at by joint observation and discussion. The six descriptions, together with the specimens, are then given to another couple, who through their own discussion and observation, will try to identify each grass from what has been written. Needless to say, the interest comes mainly from the interaction between observation and language. One thing is certain—never before will those people have looked so closely at a grass as when they were searching for the best words to describe it: unless, of course, one of them happened to be a botanical artist!

An activity such as this should certainly commend itself to teachers, since the necessary resources are free and easily available. 'Resource' is a word much in vogue nowadays. When it is mentioned in the context of education, the mind seems automatically to turn to the absence or shortage of things, rather than their provision. So far, the things I have referred to have involved little expense. On the other hand, cost effectiveness would seem to have been considerable. Perhaps we should think more about how to use what we already have, especially the things which are freely available. Of course, conservation must always be uppermost in the mind. On occasion, however, it is necessary to convince the 'providers', when you know in your heart that certain resources are essential!

My six years at Wymondham College taught me a great deal. I arrived there from teaching in a Technical College where resources were plentiful, to find two microscopes, a small box of prepared slides, and a few bits and pieces of equipment. The College had just reached the 6th Form stage, and I was told to get the teaching of Biology off the ground, and not to expect much help for the next two years!

On the positive side, there were resources of another kind which I was soon to appreciate, and which in later years I was to realise many teachers lacked, namely space in the classroom, and outside it a natural environment close to hand. These are resources you really do need, and in cramped conditions particularly, teachers are very disadvantaged. I was fortunate, too, in having a convenient school garden where students, whatever their age, interest and ability, spent a proportion of their lesson time. This aspect of my work prepared me for my advisory visits to Secondary Modern Schools, most of which had gardens of one sort or another.

The Secondary Moderns in the old County of Norfolk in due course became Comprehensives, and to-day it would be hard to find many with gardens in use, or used as they were formerly managed. There are several reasons for this, but in essence they stem from the fact that Rural Studies was thought of as a subject most suited to less able students, who in earlier days might have gone to work in the countryside. Becoming a Comprehensive meant serving a wider ability range, and this in turn was reflected by changes in staffing. More Biologists, and fewer trained teachers of Rural Studies, were appointed, with predictable consequences.

The men and women who taught Rural Studies were inclined to be independent by nature, and had a great feeling for their subject. They maintained, for the most part, that it should be craft, rather than science, based, and this resulted in some splendid gardens, often the pride and joy of the school. Against this background, you did what you could to get colleagues to accept that change was one day going to be inevitable, and therefore, that gardens should be greatly simplified and the curriculum altered to have a wider appeal. In spite of in-service training designed to meet future needs, relatively few teachers changed sufficiently, and comprehensivisation took its toll. It has meant that opportunities for first-hand experience of growing plants and maintaining and caring for a variety of animals—experiences from which earlier pupils benefited—have been greatly diminished. These pupils learned through nature, where nature was linked to home and horticulture on the one hand, and field and farming on the other.

Against this background it is heartening to learn that during the last three years, more than eighty Primary and Secondary schools have become involved in a scheme which links individual schools to farms. Appropriately called 'Farm Link', the aim is to give children the opportunity to see farming in practice, and to extend their interest in the countryside generally.

If suggestions made to teachers were not always acceptable to them, so too were those made to colleagues in Local Government circles who, for financial reasons, had necessarily to strike a balance between things desirable and things essential. In the late 1970's the Central Electricity Generating Board offered the Local Education Authority the use of the land adjacent to the transformer station at Dunston, just off the A140 and about four miles south of Norwich. The site included grassland, belts of mixed woodland, and two ponds. Next to the station itself was an administration block which the C.E.G.B. was prepared to remodel, furnish and heat, to serve as a teaching laboratory. The Board was also prepared to build extra toilet facilities and to extend an existing small car park. It did insist, however, that because of the operational nature of the site, it should be supervised and managed by a qualified teacher. Apart from a peppercorn rent, and payment for use of a telephone, there would be no other charge to the Authority.

The proposals came, unfortunately, at a time of recession, and it was not found possible to consider the appointment of a teacher and the provision of the resources which a small environmental study unit would need. The C.E.G.B. therefore withdrew its offer and schools, particularly those in Norwich and the immediate vicinity, lost what could have become a very convenient site for long and short term field studies.

The converse of the situation at Dunston can be found in the acquisition and subsequent development of the former Primary School in Wells-next-the-Sea, as a Field Studies Centre. During the 1960's I became more and more concerned that Norfolk children had few opportunities to stay in low cost residential accommodation, with easy access to a wide variety of natural habitats, and so the impending closure of Wells Primary School in 1966 presented a unique opportunity. The buildings were housed on one floor, and could be adapted without much difficulty to accommodate boys and girls separately. The school hall would make a good laboratory, and the food preparation area could be converted into a self catering kitchen. There was a cottage adjacent for a caretaker, and the playground would be ideal for parking.

In making my recommendations for the conversion and future use of the

Wells Field Study Centre.

premises, I was clear in my view that the Centre would only flourish under the direction of a warden who would need to live close by. Having convinced others of this necessity, the project was finally agreed to, and the school was purchased from Lord Leicester. The first phase of conversion took place, and I recall with some nostalgia, seeing the first coach-load of children arrive just as we finished opening the bales of blankets which had been delivered that very morning. Wells Field Study Centre was in business, and soon Paul Banham was to take over as its Warden, aided so ably by his wife Eleanor. Wells is now known throughout the Country for the quality of its field studies, and over the years it has served countless numbers of students of all ages.

However, in terms of the total school population, only a very small percentage of children can stay at the Centre in any one year. For Primary and Middle Schools the demand is such that an individual school can wait for as long as eight or nine years before being able to make a second booking—hence the need for places elsewhere.

As you know, the Local Authority still manages the large estate at Holt Hall, and field study courses form part of the activities undertaken there. The broadland estate at How Hill, where the teaching of field studies predominated, was also owned by the Local Authority until its sale in 1983. It is, of course, still open for schools to apply to go there, but the natural link with the Authority was severed at the time of the sale. When the estate was purchased from the Boardman family in 1967, the Education Department was committed to a programme of conservation of a truly unique wildlife reserve. Thus, those responsible for administration, in concert with teachers in schools, were together partners in conservation. When students went to How Hill they learned about its protection, and it was incumbent on the Education Department to see that it was properly managed for them to study.

As one of those who witnessed Ted Ellis planting a specimen conifer to commemorate the official opening, I felt that what he was also doing was to symbolise the link between education and conservation. A great naturalist had put his own seal of approval on the acquisition and management of a beautiful and vulnerable estate by a Local Authority, for the purpose of educating its students. It was not

surprising that the sale of How Hill should have been the cause of much sadness, but in one respect it had its bright side. Pat Lee, who for a number of years had been Warden, became the County's Environmental Studies Adviser in 1983 and so, for the first time, this area of the curriculum was to receive full-time attention.

A few days spent at a Field Study Centre is an experience to be remembered. For some youngsters, it will be their first stay away from home and the learning aspect apart, the occasion provides opportunities for social development. As courses come and go, the Warden and his wife play a vital role. They provide a link with the local community, and ensure that the Centre is in harmony with it. An eye is kept on possible over-use of particularly interesting sites, and alternatives are suggested to visiting schools. Their local knowledge and professional skills enable them to instruct both teachers and children, according to their various needs; a role which is always greatly appreciated. Really successful Wardens are those whose love of the environment is such that they never tire of visiting the same places over and over again, and whose pleasure in what is found there is infectious. The Centres in Norfolk have been fortunate in having Wardens of just this calibre.

In recent years, the use of school grounds for studying wild life has increased significantly. Opportunities for doing so vary from one site to another, some being blessed with natural features which were preserved when the school was built, while others have only a small corner of a playing field in which to develop one or more habitats. The best examples are not necessarily the most elaborate, nor do they occupy most ground. They tend to be the ones where the school has a very clear idea of how it will study the plants and animals it has encouraged to thrive close by, and will see such studies as part of its planned day to day curriculum. In addition, the staff will have evolved a management policy for their mini-estate, and will not have taken on more than they can cope with. Too often I have seen initial enthusiasm prevail over long term common sense, and what could have been a valuable resource becomes an under used embarrassment.

Although most developments in school grounds have been in Primary and Middle Schools, there is now evidence that some Secondary Schools are working along similar lines. Undoubtedly such a trend will be reinforced by the newer G.C.S.E. examinations where in one Biology Syllabus, for instance, an essential requirement is that students must study at first hand the ecosystems of either deciduous trees, or a freshwater pond. Examination papers will be so constructed as to ensure that such studies have been carried out.

In concluding my address, perhaps I could reflect on one or two experiences, unrelated in themselves, which gave pleasure to me and, I hope, reward and satisfaction to others.

I think back to the fieldwork undertaken by 6th form students at Wymondham College, where one of them investigated the way in which the common moss of pavements (*Bryum argenteum*) spreads from one habitat to another. He discovered that it detached tiny apical propagules, capable of regenerating new moss plants which could in turn establish new colonies. He also discovered that the propagules could be dispersed by the agencies of feet, wind and water. With this work he won the National Research Essay Competition, and at a ceremony in London, was awarded prizes for both himself and the College. On leaving school he presented a paper to the Annual Meeting of the British Association for the Advancement of Science, and later his actual experiments were to feature as part of the Nuffield 'O' level Biology course. Although this particular investigation is perhaps noteworthy, similar

work is well within the grasp of many 6th formers when they are given initial motivation and, occasionally, a little encouragement.

Another happy memory comes to mind whenever I see Alexanders *Smyrnium olusatrum* flowering in late Spring. I am reminded of an investigation, undertaken this time by the college's first year pupils. Having been shown a specimen plant just before the Summer half-term holiday, they went off to their various homes throughout the County. They were asked to look for Alexanders, and if they found any, to note where they were growing, and to bring back a leaf as evidence. After half-term their findings were plotted on a map, with some interesting results. Not surprisingly, boys and girls who lived near to the coast found a number of sites. Those plotted from inland returns also showed a measure of consistency, in so far as Alexanders appeared to favour ground rising up from river valleys. Over the years I have found this to be true, but the reason for it has remained unclear. This experience was particularly rewarding, since it was undertaken so enthusiastically, and forged links between the pupils' homes and their school.

Observing together and sharing investigations are the sorts of things which make teaching so worthwhile, and during my advisory work I used to arrange residential courses where each teacher brought along a couple of students. In this way, teachers were able to evaluate their students' level of interest in the work being undertaken. One such course took advantage of Alec Bull's long standing work on grass verges, and he generously gave much valuable time and advice in helping to arrange it. Based at the Wells Field Study Centre, various verges in the area were investigated, and the results recorded and quantified. The participating schools were then in a position to undertake similar studies in their own districts. My memories of these courses are that they were great fun and that a marvellous spirit existed between the teachers and students, all of whom were in a learning situation together.

Finally, I would mention one particular event which may indicate something of the character of school work when it is based on first-hand experience. By arrangement with the Head of a Secondary Modern School in North Norfolk, I visited a group of four teenagers, who that July afternoon would finish their schooling and go out into the adult world. I should point out that they had no knowledge of my impending visit, and that the last time I had seen them was some four years earlier when they were attending a nearby village Primary School.

It was at that school that these youngsters had been involved in studying a small stream, which flowed through an adjacent meadow. Their teacher, who had some reservations about an open ended approach to learning out of doors, was nevertheless spirited enough to try his hand, and he and the children studied the water that flowed, and the life it supported. It turned out to be a fascinating piece of work involving science, natural history, mathematics, art and craft, and when some Schools' Inspectors from Malawi were visiting the County, I took them along to see what was going on.

Now, four years later, here were these teenagers chatting to me about the work they had done while at their village school. They certainly remembered their overseas visitors, who had been so friendly and interesting. But they also recalled, with very little prompting, so much of what they had experienced at the stream and, perhaps more importantly, what had arisen from it back in their classroom. They had indeed learned through Nature, and they had retained a good deal of what they had learned. Perhaps they still remember!

PLANT NOTES FOR 1987—The sudden death of Dr Petch leaves a large gap in the ranks of Norfolk botanists. It also leaves a gap in this report of Norfolk plants for 1987. The last excursion that I enjoyed in his company was as recently as 15 October when, in company with Dr Tim Rich, the Botanical Society of the British Isles monitoring scheme organiser, we visited Holme/Thornham saltings before moving on to Brancaster. Charles then left us, and Tim and I continued on to Morston, for further studies of the genus *Salicornia* in the by now pouring rain. *Salicornia*/glasswort/samphire, call it what you will, is a difficult genus. The Flora of Norfolk gives it a lengthy preamble, and deals with only a few West Norfolk sites. In the Supplement to the Flora, ETD has gone a little way towards redressing the balance, but opinions continually change, and there is still a long way to go. Tim had with him a new key for the genus recently produced by Francis Rose, which enables them to be effectively studied at the fruiting and die-back stage, as the die-back colour at maturity is often diagnostic. Other features, such as the scarious margins of the 'leaves', or absence of them, are best seen at this season. Large quantities of specimens were taken from the various sites, and classified using the 'Rose' key, as best we could in the field. For cross reference, Tim brought out a copy of

the key to the genus taken from the 3rd edition of Clapham, Tutin and Warburg (*Flora of the British Isles*). Though it gives credence to the autumn colours, this key starts "Flowers with one stamen" and "Flowers with two stamens", so is of no use in the autumn, when the stamens have long since disappeared! The material collected was all taken back to Monks Wood and subjected to critical examination, all the determinations being given below.

Salicornia pusilla TF74 Holme; Thornham; Brancaster; TG04 Morston.
Salicornia pusilla x *ramosissima* TF74 Brancaster; TG04 Morston.
Salicornia ramosissima TF74 Holme; Thornham; Brancaster; TG04 Morston. This is the common species on almost, if not all Norfolk saltmarshes.
Salicornia europaea TF74 Thornham, Brancaster; TG04 Morston.
Salicornia dolichostachya var. *fragilis* TF74 Holme; Thornham; Brancaster; TG04 Morston. Some of the material from Holme matched *Salicornia lutescens* sensu 3rd Ed. of CTW
Salicornia dolichostachya var. *dolichostachya* TF74 Thornham; TG04 Morston.
Salicornia perennis TF74 Thornham, Brancaster.

In a totally different sphere, three of our members took part in the BSBI's arable weed survey. They sent in 36 completed cards, all containing details of one or more species of declining arable weeds that can still be found in Norfolk fields. Quite by chance, the three members each looked at a different soil type. Mrs Cooper's chosen fields for study were all on the clays to the south of Norwich, chiefly round Shotesham; Mrs Humphris searched the sands round Taverham and Attlebridge, and Mrs Brewster went round the fields she knows so well on the mixed soils west of Aylsham. One thing which emerged was that venus looking glass *Legousia hybrida* had an excellent year, Mrs Brewster finding it in many fields, while Mrs G. Beckett, engaged in a survey of unsprayed headlands on the Hilborough estate, states that it was present there in hundreds. Other species recorded included pointed leaved fluellen *Kickxia elatine* in several fields, chiefly on the heavier soils, weasel's snout *Misopates orontium* on poor acid sands, long prickly fruited poppy *Papaver argemone* including a thriving colony on a farm wall, night flowering catchfly *Silene noctiflora* and corn wound-wort *Stachys arvensis*.

The rare Breckland grass, dense silky bent *Apera interrupta* was frequent on a roadside and field margin at Quidenham (R&LE). This species provided an East Norfolk first county record when it was discovered, though difficult to spot amongst massed *Vulpia myuros* beside the road across the old Swannington airfield (ALB).

Among other West Norfolk records from GB were lesser meadow rue *Thalictrum minus* and tall broomrape *Orobanche elatior* still growing on a hedgebank between fields on the Hilborough estate—which suggests that their past spraying has not been as intensive as it has in some other parts of the county. The *Orobanche* also made a good showing on its traditional site at West Acre (GB) and along the former railway track where it was originally found by R. P. Bagnall-Oakley between Stody and Hunworth in 1972 (ALB).

Mr G. Nobes of Carbrooke invited me to go over and identify two plants which had appeared on soil he had recently brought into cultivation. These were both aliens, one being the hairy gallant soldier *Galinsoga ciliata* which seems to be increasing. The other, from the Mediterranean, was more difficult to explain. This was *Ammi majus* a rather graceful member of the parsley family.

A long list of plants from ETD mainly from the Norwich area included several naturalisations from such places as the Rosary cemetery, Earlham cemetery and

Bracondale Woods, emphasising the importance of semi wild corners such as these to the wildlife of the city, and the importance of keeping records of what is going on in them. For instance: spring snowflake *Leucojum vernum*—Numerous plants flowering well in a semi-woodland habitat, Rosary cemetery 14 March.
Corydalis solida - Very abundant in Bracondale Woods and a piece of waste ground near Carrow Abbey. These and all ETD's other Norwich records will be filed for posterity, as, perhaps in a hundred years time, they may explain to twenty second century botanists where some of the plants they may come to regard as commonplace first originated.

Outside the city he also provides us with an intriguing record of the wild grape hyacinth *Muscari neglectum* = *atlanticum*. This can still be found on some protected roadside verges in the Suffolk Breck, but the Flora of Norfolk records it as long extinct in its former Norfolk homeland round Harleston. Not too many miles further down the Waveney Valley lies Geldeston where ETD found a clump flowering on a warm dry bank beside a narrow lane. Almost all Norfolk records can be referred to the cultivated *Muscari armeniacum*, which will also persist for a long time. One cannot say how long the present plant has been at Geldeston, though even if there were one or two spikes, it would not necessarily mean that the plant was of recent introduction. Mrs G. Crompton has kept notes on a clump in the Suffolk Breck which had exactly the same number of flowering spikes in 1987 as it did in 1967.

Spurge laurel *Daphne laureola* is another declining species. A very slow growing undershrub, it is nice to report that ETD found two young bushes in Bracondale woods. Some older shrubs were also found in hedgerows at Manor Farm, Downham near Wymondham on a Society excursion.

Midland hawthorn *Crataegus oxyacanthoides* is still to be found at Arminghall where it was discovered by John Silverwood (ETD).

Dark mullein *Verbascum nigrum*—three plants with white flowers on a roadside at Kilverstone where it had been seen 15 years previously (ETD).

Water soldier *Stratiotes aloides*—some quantity in a flooded disused gravel pit at The Lizard, Wymondham. Perhaps this was from seed brought in on ducks feet, having flown from the Broads or perhaps somebody's aquarium emptyings? Who can tell! (MH).

The wet summer and autumn produced fine displays of colour from such species as corn marigold *Chrysanthemum segetum* on sugar beet fields both in the centre and north-west of the county (ALB, GB). It also helped the germination of such spring-flowring annuals as *Teesdalia* in the Brecks (GB). On the other hand, many species produced a very sparse seed crop due to the dull damp conditions preventing pollinating insects from doing their work. Let us hope that 1988 will be otherwise.

GB, Mrs G. Beckett; ALB, A. L. Bull; ETD, E. T. Daniels; R&LE, Mr & Mrs R. Evans; MH, Miss M. Haycock.

If you find any interesting plants during 1988, don't hesitate to write and tell me about it. If you live in the west of the county the new vice county recorder is Mrs G. Beckett, Bramley Cottage, Stanhoe, King's Lynn PE31 8QF. If you don't write and tell us, then you can't grumble if someone comes along and ploughs it up or cuts it down!.

A. L. BULL, Hillcrest, East Tuddenham, Dereham, Norfolk.

THE LICHEN FLORA OF NORFOLK

P. W. Lambley

Biology Department, P.O. Box 320, University of Papua New Guinea, Papua New Guinea.

Introduction

The Norfolk lichen flora has been studied for about two hundred years and was one of the best known counties by the early nineteenth century due to the pioneering efforts of Sir James Edward Smith, Dawson Turner and others. Later the Reverend E. N. Bloomfield compiled the first comprehensive flora which was published in 1905. S. A. Manning has made some further important contributions in a series of papers published between 1938 and 1960. However, the period since 1958, the year the British Lichen Society was founded, has seen an unprecedented growth of interest in this group. Many species have been added to the British list and there have been major taxonomic changes. At the same time there has been a growing awareness of the importance of lichens as indicators of environmental change. For these reasons it seems an appropriate time to publish a lichen flora of the county. This work shows that although the county has not a very rich flora it does have features of interest especially those associated with its wealth of magnificant medieval churches, the Breckland grass heaths and its coastal dunes and shingle. It is also evident that further studies will undoubtedly add new species and revise notions of abundance, so this flora cannot be considered to be definitive.

Norfolk is a seacoast county on the east coast of England. With an area of 5321 km^2 it is one of the largest English counties. It is bordered on the north and east by the North Sea and on the west by the Wash and the counties of Lincolnshire and Cambridgeshire, while the rivers Ouse and Waveney form its southern boundary with Suffolk.

The Flora relates to the Watsonian vice countries of West and East Norfolk (vc 28 and 27) though they are treated as one. For the most part the administrative county and vice county boundaries are the same, the only significant deviations are in the east where the northern part of Lothingland was taken from Suffolk and added to the county in 1974 and Thetford Warren in the south west which is in the vice county of West Suffolk (vc 26) but in the administrative county of Norfolk. This latter area has caused problems in the past as many lichen records from this site have been wrongly assigned to West Norfolk. There are also a few minor differences in the Fens but they are of no lichenological significance.

The nomenclature follows Cannon, Hawksworth and Sherwood-Pike (1985). Names used in the 1980 checklist by Hawksworth, James and Coppins, where different, are included in brackets after the checklist name. There are a few instances where species described since the publication of the checklist and newly created genera have been included.

The history of lichenology in Norfolk

The frequency with which Norfolk localities feature in early lichen accounts is a testimony to the prominent role played by the Norfolk botanists of that time in the study of lichens in the British Isles. Two people in particular, Sir James Edward Smith and Dawson Turner were leading lichenologists of their day and made significant contributions to our knowledge of the flora.

Sir James Edward Smith, 1759-1828, is perhaps best known as the purchaser

Trans. Norfolk Norwich Nat. Soc.
1988 **28**(1), 13-32.

of the Linnaeus collection. He was also responsible for the text in Sowerby's English Botany. This includes accounts of most of the lichen species known in Britain at that time. Many of these accounts refer to species and localities found by himself and his friends. The book is one of the few instances where the artist gets most of the credit and the author of the text remains largely anonymous. Smith was born in Norwich and after graduating as a doctor in Edinburgh and working for a time in London he returned to his native city in 1796 and spent the rest of his life there, living in a house which still stands in Surrey Street. For a fuller account of Smiths' life see Geldart (1904). Dawson Turner, 1775-1858, was the son of a Yarmouth banker and went to Cambridge to study for the church. However, the early death of his father forced him to abandon his intended career and return home to manage the bank on the Quay at Yarmouth.

A man of tremendous energy, he found time to study cryptogamic plants and to publish a number of important works on these hitherto neglected groups. He was responsible for the discovery of a number of new species of lichen including *Caloplaca luteoalba* and *Chaenotheca chrysocephala*. From about 1820 onwards his interests became increasingly that of an antiquarian. Probably his most important published lichen work is Lichenographica Britannica or An attempt at a History of British Lichens which he wrote with William Borrer of Henfield in Sussex. This work was begun in 1812-13 but never completed. Because of the death of the printer the sheets lay neglected in the printers warehouse damaged by insects and damp, until the remaining sheets were made up together with an introductory letter to Borrer and a supplement and published for private circulation in 1839. Turner also contributed the list of lichens in the sketch of the Natural History of Yarmouth by C. J. & J. Paget (1834).

Smith and Turner had many botanical friends in the county with whom they corresponded and visited. For instance places owned by James Crowe (1750-1807), figure frequently amongst the records. Smith described Crowe as 'a most excellent botanist'. His special interest was willows, an interest he shared with Smith. He also however owned land at Lakenham now within the city boundary and most of the parish of Saham Toney near Watton. The first record for *Parmelia acetabulum* for Britain is by Smith from Mr Crowe's land at Saham Park. Turner found and described *Chaenotheca chrysocephala* as a new species from Crowe's barn at Lakenham. Barton Bendish and Fincham also feature in early accounts. Fincham was the living of the Reverend Robert Forby (1759-1825) another able botanist. Turner went to stay with him as a resident pupil after leaving North Walsham Grammar School. It was at Boughton that Turner found *Arthonia impolita* for the first time in Britain. The Reverend Henry Bryant (1721-1799) rector of Colby also communicated some records including *Catapyrenium lachneum* which were published in the Botanists Guide. Another locality which features frequently is Coltishall where Turner had relatives. It is from material collected by Turner there that Laundon found *Lecanora populicola* (Laundon, 1970). Dawson Turner had a brother, James (1786-1820) who was also interested in lichens, and a number of records from the Harleston area in the Botanist Guide are attributed to him.

It was fortunate that Smith, Turner and the others were able to do so much at the end of the eighteenth and beginning of the nineteenth centuries because 'nearly all the acts of parliament for the improving and drainage, enclosure and allotment of marsh and common lands came into force during the life of Sir James Smith. The whole face of the county was rapidly changing.' (Geldart, 1914).

The Reverend Kirby Trimmer (1804-1887) the vicar of St. Georges, Tombland, Norwich was the author of the first Flora of Norfolk. He also had some interest in lichens and collections made by him survive at the Castle Museum Norwich. Specimens in the herbarium of S. A. Manning are also almost certainly collected by him and include *Moelleropsis nebulosa* from Felthorpe.

The first attempts at complete lists of lichens were made by Crombie in the Victoria History of Norfolk published in 1901, followed by a more complete list published in 1905 by the Reverend E. N. Bloomfield (1827-1914) the rector of Guestling in Sussex, though a native of Great Glemham in Suffolk. This flora is a combined Suffolk and Norfolk list and includes most of the early records.

Blakeney Point was the site of early pioneer studies on lichen ecology by McLean. The results were published in 1915. This was followed by further ecological work by Richards which was published in 1929. These studies were followed up by Brown and Brown in the 1960's and their results were published in 1968 and 1969.

Samuel Manning began to take an interest in lichens in the mid 1930's when he took his first specimens to Ted Ellis at the Castle Museum (Manning 1983). Since then he has made many important records in the county and published a number of papers on the flora. New records for the county made by him include *Coriscium viride, Collema limosum* and *C. cristatum.*

The resurgence of interest in lichens in the British Isles was marked by the formation of the British Lichen Society in 1958 and reflected in visits to the county by Peter James who came to study the lichens on Scolt Head Island. In 1968 the British Lichen Society held its autumn field meeting at King's Lynn, this was attended by David Hawksworth, Oliver Gilbert and Dr Francis Rose. It was the beginning of an intensive period of mapping the county's lichen flora. Dr Francis Rose has subsequently made frequent visits to the county and contributed considerably to the knowledge of its lichens. I started to take an interest in lichens in 1970 and with the encouragement of Dr Rose began to work on the flora and which I have continued until I left the county in 1984. Other lichenologists who have visited the county since 1970 include, Dr Brian Copping, Dr Oliver Gilbert, Peter James, Jack Laundon and Dr Mark Seaward. Dr Christopher Hitch has made a series of visits to the county from his neighbouring home county of Suffolk and has helped to add a number of critical and small species to the list.

Herbaria

The main collections of Norfolk lichens are held at the Castle Museum, Norwich; British Museum (Natural History) and the herbarium of the Linnaean Society. There are also early collections at Edinburgh. S. A. Manning holds a private herbarium which includes material probably collected by Kirby Trimmer.

Factors influencing the distribution of lichens

Climate

The county is situated within one of the driest areas of the British Isles. From the figures given in the *Eastern Daily Press* by T. B. Norgate the annual rainfall over the 10-year period (1966-1975) varies from 686 mm (27") and above in the north-east to 515-525 mm (23-25") in the south-west. The higher rainfall of the north-east is due to moisture-laden winds from the North Sea augmented by frequent sea mists and this tends to give this part of the county a para-oceanic type of climate. The south-west, particularly the Breckland, in contrast tends to have a more con-

tinental type where temperatures are a little more extreme with slightly hotter summers and colder winters. Later frosts are also a feature of the area. These differences are illustrated in Table 1.

Table 1 Average daily maximum and minimum temperatures.

Temperatures (deg. C.)	January maximum	January minimum	July maximum	July minimum
Great Yarmouth	6.1	2.2	19.4	13.3
Cambridge	6.7	0.6	22.2	11.7

The highest sunshine levels are along the east coast which have an average mean duration of over 4.5 hours of bright sunshine where as the rest of the county has 4-4.5 hours.

Geology

There is no simple relationship between the geology of the county and the distribution of lichens, nevertheless it is a determining factor. The two most pertinent features are the absence of naturally occuring rock outcrops and the prevalence of Pleistocene drift deposits which mask much of the solid geology. The solid geology is relatively simple with strata dipping gently eastwards. The oldest rocks, Jurassic clays, underlie most of Fenland and are succeeded by lower greensand and gault clay which outcrop along the eastern Fen edge. These in turn are overlain by chalk which is in turn overlain by Pleistocene crags to the east of Norwich. The lower greensand is the most significant of these deposits for lichens as it gives rise to sandy soils on which the heaths of Roydon, Ling and Dersingham are developed. Carstone is a ferruginous sandstone within the lower greensand which has been used extensively as a local building stone and in rockeries. Although a rather poor substrate for lichens, several species like *Hypocenomyce scalaris* show a preference for it. The other important substrates for lichens are the flint nodules from the chalk which occur both naturally in extensive shingle banks along the coast and are incorporated into buildings. Other stones and brick are also used and are discussed more fully in a later section.

The superficial deposits of glacial sands, gravels and clays determine the distribution of heathland lichens over the rest of the county away from the greensand ridge. The plateau gravels and sands of the north east part of the county support heaths like Cawston, Marsham, Buxton, Sheringham and Weybourne. The south-east part in contrast is covered in calcareous boulder clay and this accounts for the absence of heaths and therefore *Cladonia* communities in this area. In the Breckland the chalk is covered by sands of varying depth and acidity. The special Breckland lichens like *Squamarina lentigera* and *Buellia asterella* are restricted to sites where the chalk is not masked by these sands, while acid heath communities are developed in a few places as at Bridgham Heath.

Topography

The county is low lying with only two places (Swanton Novers and Roman Camp near Sheringham) just reaching 100 metres altitude. It is mostly gently undulating, and deep sheltered valleys favoured by many of the more exacting lichens are virtually absent. However, the only really flat landscapes are those of the Fens and

the lower reaches of the Broadland rivers. The treeless flat landscape of the Fens is very unfavourable for lichens, Broadland is a better habitat as there are many wet woodlands (carrs), which support a moderately abundant flora. The Breckland in the south-west of the county and the north-west of Suffolk is a distinctive area of light sandy soils over chalk, while there is a crescent shaped area extending from near Melton Constable in the north to the Harleston area in the south-east which is generally rather more wooded than the rest of the county. The North Norfolk coast is a marshland one with a complex series of sand dunes, salt marshes and shingle ridges which provide interesting habitats for lichens.

Landuse

Norfolk is primarily a rich agricultural county and much of the land is farmed intensively. Arable farming predominates though permanent grasslands remain in the river valleys and in parts of Broadland. Modern agricultural practices have made a profound impact on the lichen flora through the physical removal of miles of hedgerows and their associated trees and by the widespread use of inorganic fertilisers which appear to be harmful to many lichens (James, 1973). The demise of the *Xanthorion* on trees is a consequence of these developments. The reclamation of heathlands for agriculture has also resulted in the loss of several sites including half of Cawston Heath in 1969 and Elsing Common in 1983.

Another major landuse in Breckland is forestry. Most of these forests were planted in the 1920's and 30's on land considered to be unproductive. It is not known whether any important lichen sites were lost at that time but the present day forests are of little interest lichenologically. The ancient woodlands which remain in the county have generally survived because of sporting interests. Some of these like Swanton Novers Great Wood are now managed with nature conservation as one of the objectives. As Norfolk is farmed so intensively, it is fortunate that the county is comparitively rich in commons and poorsland, which provide oases for many of the commoner species. Many Norfolk parks also retain their parkland though some like Kimberley have lost some pasture to the plough. Nature reserves are now a significant landuse within the county and protect some of the most important sites like Blakeney, Scolt Head Island, the Holkham area, Winterton, Weeting Heath, Thursford Wood and Swanton Novers Great Wood. These and other important lichen sites are mapped in Fig. 1. In some instances man's activities can provide new lichen habitats such as sand and gravel workings though these are usually temporary.

Air pollution

Coppins and Lambley (1974) studied the lichen flora of the Suffolk parish of Mendlesham, comparing the flora known to be present in the period 1914-21 with that in 1972-73. They found that 48.1% of the taxa present in the earlier period were absent fifty years later. They concluded from the evidence that this was largely due to air pollution from the Midlands and London areas. The situation in Norfolk is apparently similar with the lichen flora of large parts of the county showing signs consistent with the known effects of air pollution.

Hawksworth and Rose (1970) proposed a scale using lichens on trees as indicators of different levels of air pollution. The scale runs from 0 to 10 with 0 being the equivalent of the highest levels of air pollution (callibrated to the winter mean sulphur dioxide level) and 10 the lowest. When the scale is compared with the lichen flora

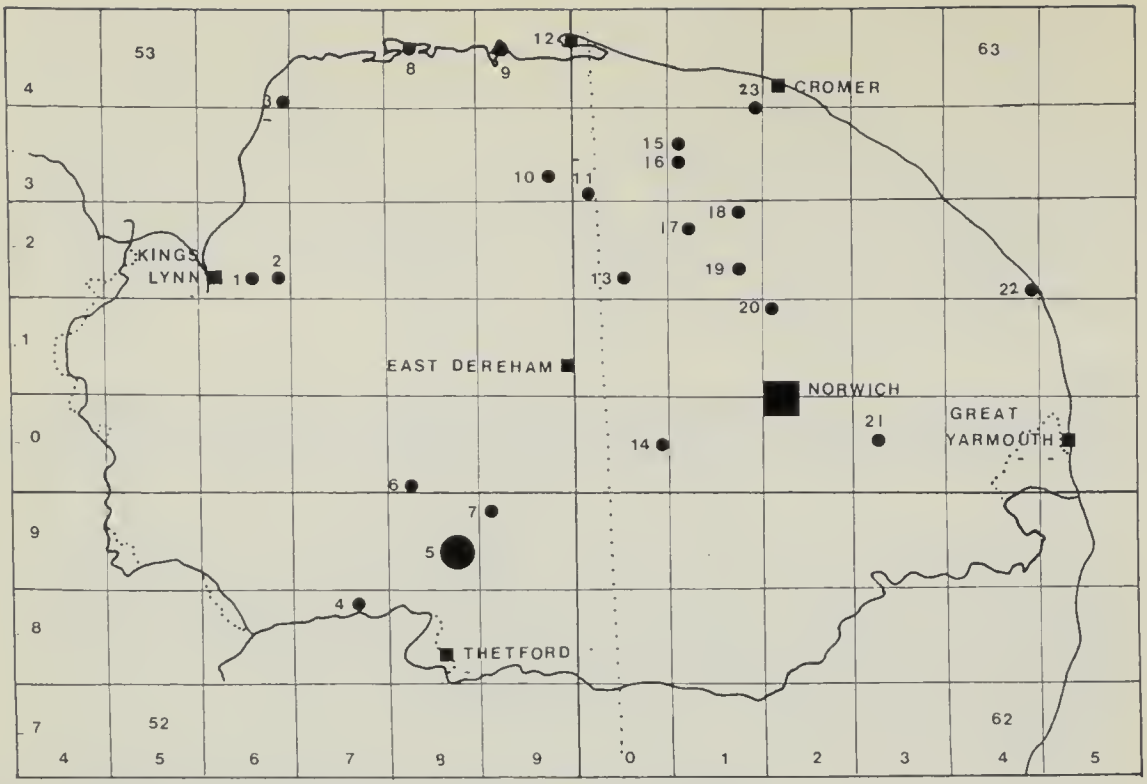


Fig. 1 Map showing important lichen sites in Norfolk.

1. Ling Heath 53/6523.
2. Roydon Common 53/6822.
3. Hunstanton Park 53/6941.
4. Weeting Heath 52/7687.
5. Stanford Training Area 52/8594.
6. Hilborough Park 53/8200.
7. Merton Park 52/9197.
8. Scolt Head Island 53/8046.
9. East Hills, Wells 53/9245.
10. Thursford Woods 53/9733.
11. Swanton Novers Great Wood 63/0131.
12. Blakeney Point 63/0046.
13. Foxley Wood 63/0522.
14. Kimberley Park 63/0904.
15. Pond Hills 63/1035.
16. Edgefield L. Wood 63/1034.
17. Heydon Park 63/1127.
18. Blickling Park 63/1629.
19. Marsham & Cawston 63/1623.
20. Horsford 63/2017.
21. Wheatfen 63/3205.
22. Winterton Dunes 63/4920.
23. Felbrigg 63/1939.

of much of the county it is found to be equivalent to the lower part of zone 6 (ie equivalent to a winter mean of about 50 $\mu g.m^{-3}$ with species like *Parmelia caperata, Caloplaca luteoalba* and *Pertusaria* species being quite widespread. However the flora of many hedgerow trees is often even poorer, in part probably due to the effects of agricultural chemicals. In the north of the county and in the Breckland, species considered to be more sensitive to air pollution appear, eg *Anaptychia ciliaris, Caloplaca cerina, Parmelia perlata* and *Ramalina fraxinea* suggesting air pollution levels are lower. The species are indicative of zones 7 and 8 (ie equivalent to a mean winter SO_2 level of 35-40 $\mu g.m^{-3}$). Norwich does not seem to be a major source of air pollution. *Parmelia sulcata* occurs on plane trees in Chapelfield Gardens in the centre and species like *Arthonia impolita* grow on trees in Earlham Park on the ci-

ty's western fringe. The deterioration of the lichen flora at Wheatfen observed by Dr E. A. Ellis (pers. comm.) in the 1950's might have been due to Norwich power station seven kilometers away. However the power stations along the Trent and elsewhere in the Midlands and London area are probably the main sources.

Air pollution measurements from rural areas are few but some incomplete figures from Holme in north-west Norfolk are given in Table 2.

Table 2. Sulphur dioxide concentrations ($\mu g.m^{-3}$) at Holme.

			1975			1976		
	June	July	Aug	Sept	Dec	Jan	Feb	March
Mean Average	19	21	21	19	31	21	38	26
Highest Daily	43	48	32	44	108	43	90	54

It is possible that acid rain may also play a part in the observed effects. The changes observed at Horsford in the mid 1970's may be attributable to this cause. Here a rich community with species like *Parmelia perlata, P. caperata, Usnea intexta* and *U. subfloridana* showed obvious signs of deterioration. The site is very sheltered and not near any farm land so agricultural chemicals were not implicated. A similar improverishment appears to have taken place at some other acid woodland sites eg Bawdeswell Common.

Lichen habitats

The principal habitats for lichens in Norfolk are a) churchyards and stonework generally, b) heathlands, c) coastal sites and d) woodlands, parklands and hedgerow trees. These all have characteristic communities the more important of which are described below.

Churchyards and other saxicolous habitats

There are about 650 churches dating from medieval or earlier times in Norfolk (Pevsner, 1962a, b) and these comprise the most important habitats for lichens growing on stone in the county. The churches are usually built of flint and mortar with oolitic limestone used for buttresses, corners and drip courses. In the west of the county though, the iron rich rather friable carstone was often used and also sometimes the hardest beds of chalk called Melbourne rock. Elsewhere in the county erratics of igneous and metamorphic rocks were sometimes utilised as at Mautby near Yarmouth. In places an iron conglomerate was also incorporated in to walls. The older headstones are usually made of oolitic limestone and less commonly sandstone; more recent ones are often of marble, granite or reconstituted limestone. The sides of table tombs are of brick or oolitic limestone, but the capping stone is often a much harder grey limestone. Many churchyards also have a brick and flint surrounding wall which provides an additional habitat.

These churches thus have a variety of microhabitats which are characterised by different communities of lichens. The north walls for instance are damp and lightly shaded and bear a distinct community, the *Dirinetum stenhammariae.* The dominent species is usually *Dirina massiliensis* f. *sorediata* (=*D. repanda* f. *stenhammarii*), but other species in this community include *Haematomma ochroleucum* var

ochroleucum, Leproplaca chrysodeta, Lepraria incana, and *Opegrapha chevallieri* (= *O. saxatalis*); the latter more especially near the coast. On some churches close to the sea such as Waxham and Happisburgh there is an extensive development of a community dominated by *Ramalina lacera* (= *R. duriaei*) and *Ramalina farinacea*. The very rare eastern species *Lecanactis hemisphaerica* is found on these sheltered northern and western walls, usually in especially dry positions such as under drip courses.

In contrast, south facing walls are well lit and have a species-rich lichen flora. The community in these situations is the *Caloplacetum heppianae,* which is characterised by the presence of many species of *Caloplaca* especially *C. flavescens* (= *C. heppiana*), *C. aurantia, C. citrina, C. holocarpa, C. ruderum, C. saxicola* (= *C. murorum*) and *C. teicholyta*. Other lichens usually present include *Diploicia canescens, Diplotomma alboatrum, Lecanora campestris, L. crenulata, L. dispersa, Phaeophyscia orbicularis, Physcia adscendens, Physconia grisea, Verrucaria* species and *Xanthoria calcicola* (= *X. aureola*). This community also occurs on the vertical surfaces of headstones.

However, it is possible to distinguish variants of this community which relate to various microhabitats. For instance the sloping surfaces of church window sills tend to be richer in *Physica* species and it is apparently the optimum habitat for *Caloplaca teicholyta* which is often found in fruit on sloping surfaces. Dripcourses are also the main habitat for *Caloplaca aurantia* and *Aspicilia subcircinata*, both apparently preferring slightly more eutrophic situations. Isolated blocks of ironstone incorporated into the walls are often covered in *Diploicia canescens*, perhaps with *Lecanora dispersa*. Crumbling brickwork on old buttresses provides a habitat for *Diploschistes scruposus* and occasionally *Polysporina simplex* (= *Sarcogyne simplex*). Carstone walls have a similar flora to brickwork and ironstone with *Hypocenomyce scalaris* occuring quite frequently.

The tops of calcareous headstones and table tombs are dominated by the *Physcietum caesiae,* a community associated with eutrophic conditions. *Physcia* species predominate and include *Phaeophyscia orbicularis* and *Physconia grisea*. Other lichens which occur in this community include *Candelariella medians, Xanthoria calcicola* (= *X. aureola*) and *X. parietina* (Fig. 2).

Table tombs are also the only habitat where communities characteristic of damp limestone occur. These are common in Western Britain but rare in East Anglia, though for some reason they seem to be even rarer in Norfolk than Suffolk. This community, the *Placynthietum nigri,* is generally represented by only fragmentary examples. Species characteristic of this community include *Placynthuim nigrum, Collema auriforme* (= *C. auriculatum*), *C. crispum, Leptogium* species and *Verrucaria* species. *Protoblastenia rupestris, Aspicilia calcarea* and *A. contorta* though not confined to this habitat are perhaps most frequently found here.

Acid tombstones have a distinctive but generally poor flora, especially on vertical surfaces with species such as *Psilolechia lucida, Lepraria incana, Lecanora conizaeoides, Candelariella vitellina, Huilia tuberculosa* and *Haematomma ochroleucum* var. *ochroleucum*. Horizontal surfaces have a richer flora with species like *Acarospora fuscata, Lecanora muralis, L. polytropa, Parmelia glabratula* ssp. *fuliginosa, P. mougeotii, P. saxatilis, P. sulcata* and *P. verruculifera*.

The flora of church roofs is understandably less well known but communities dominated by *Rhizocarpon geographicum* are known from a number of sites, usually where slates or tiles have been used. The hard red tiles of country cottages have

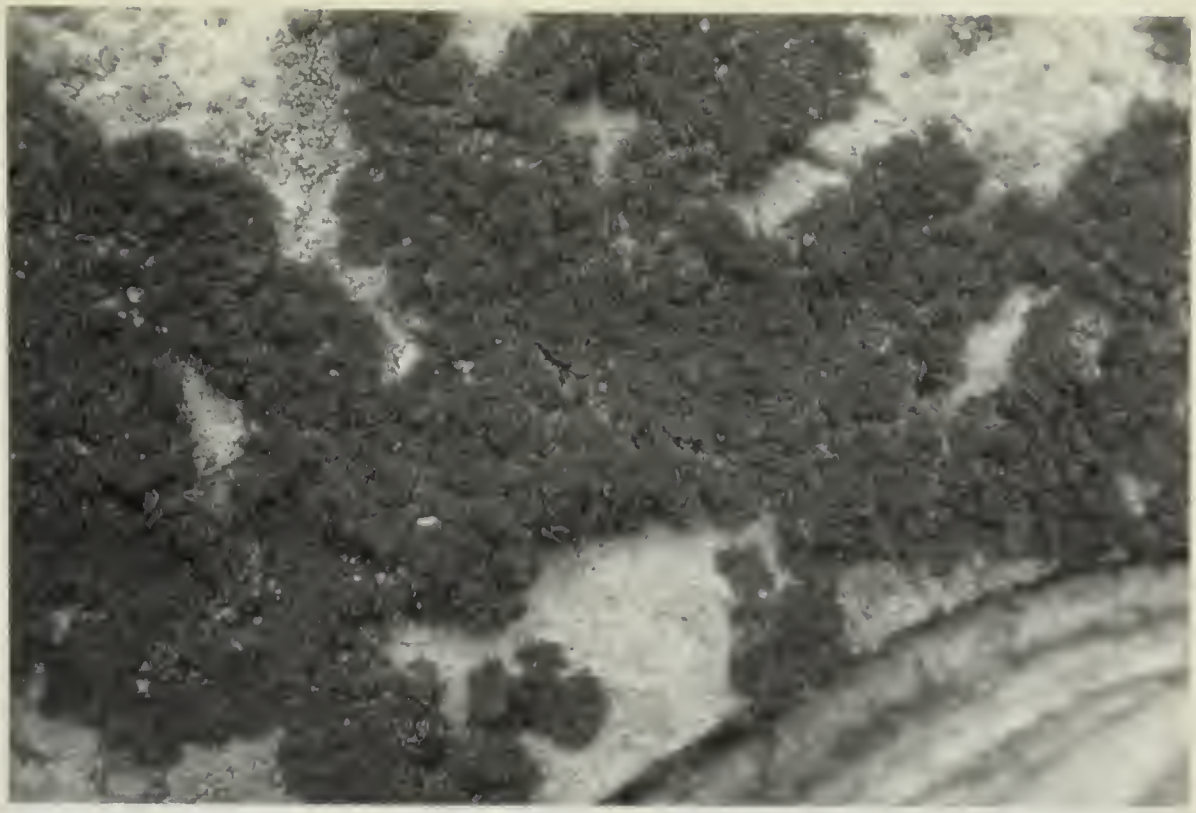


Fig. 2 *Xanthoria parietina* — a familiar yellow species found in a wide variety of open situations.

Parmelia glabratula ssp. *fuliginosa, P. mougeotii, P. verruculifera* and *Candelariella vitellina*. Tiles used in modern houses support a community largely absent from churches and include *Caloplaca decipiens* and *Xanthoria elegans*. Another community more characteristic of urban sites is one where *Stereocaulon nanodes* and *Lecanora conizaeoides* are the only species, this is usually developed on acid stone or brickwork especially alongside main roads.

Heathlands and other terricolous habitats (excluding coastal sites) -
Acid heaths

Inland heaths were formerly widely developed on the greensand ridge of west Norfolk and the glacial sands and gravels which occur elsewhere but particularly in the north east of the county. However, enclosures and associated agricultural improvements in the late 18th and early 19th centuries greatly reduced their former area. Reclamation has continued to the present time with the remaining heathlands being subjected to encroachment from agricultural, forestry and recreational interests. Consequently the heathland which remains is very fragmented, though several extensive heaths do survive, notably, Roydon and Dersingham on the greensand, and Marsham, Cawston and Salthouse on the glacial sands and gravels.

These heaths have a sub oceanic character despite being situated on the dry eastern side of England. This is exemplified by the abundance of western gorse *Ulex*

gallii and the three heaths *Calluna vulgaris, Erica cinerea* and *E. tetralix*. The lichen flora is similar to those of other parts of the south and east of England, though species associated with peaty soils are much less common than in the New Forest. Of the heaths that remain Cawston and Marsham appear to be the richest, although as lichen communities in heathland tend to be successional this may only be for the present.

The lichen flora of the drier parts of these heaths is dominated by species of *Cladonia*, the species present depending on the stage of the succession and possibly other factors. However, in general the following species are frequent. *Cladonia arbuscula, C. cervicornis* var. *verticillata, C. ciliata* var. *tenuis, C. coccifera, C. crispata, C. floerkeana, C. furcata, C. glauca, C. portentosa, C. squamosa* and *C. uncialis* ssp. *biuncialis*. Other lichens widespread on heaths include *Baeomyces rufus, Coelocaulon aculeatum, Hypogymnia physodes* and *Placynthiella uliginosa* s.lat. (= *Lecidea uliginosa* s.lat.). A feature of Cawston and Marsham heaths is the abundance of *Cladonia glauca*, a species which is rather common on heathlands in the Netherlands and other nearby parts of the continent. Marsham Heath is also notable as one of the few southern localities for *Cladonia sulphurina*, a species with a northern distribution. It is confined to an area of about one square metre in *Calluna* dominated heath.

On the damper parts of heaths other species are sometimes present. For instance limited areas of damp peat at Cawston provide the only station in the county now for *Pycnothelia papillaria*, where it grows with *Baeomyces rufus*. Another species preferring peaty substrates is *Cladonia strepsilis*, which so far as only been found one damp peaty slope at Bryants Heath, though apparently suitable habitats occur also at Buxton Heath and Holt Lowes.

An epiphytic community occurs on *Calluna* at Cawston with species like *Hypogymnia physodes, Micarea nitschkeana, Platismatia glauca, Pseudevernia furfuracea*, and *Usnea intexta*. Fragments of this community are found elsewhere but *Hypogymnia physodes* is the only macrolichen that is at all frequent.

Ling Heath and North Wootton Common are two adjacent heaths and are one of the few localities in lowland England for *Cetraria islandica*. It has been known in the area since the mid nineteenth century when it was discovered by Plowright. The main colony occurs under birch in a habitat apparently very similar to the other lowland site at Lingwood Warren in Lincolnshire. The ground is mostly bare with just a scattering of relict *Calluna* bushes. In the present circumstances it is difficult to establish whether this is a relict colony surviving from an open *Calluna* community or whether it is characteristic of the birch successional stage in this part of England. In Denmark and the Netherlands it is not uncommon on dune systems.

Heathland type communities also occur in the artificial habitat of abandoned sand and gravel pits. Those at Hoe and Sparham have quite well developed communities. The various processes of gravel washing and sorting provide habitats which may remain open for considerable lengths of time. The sand pit at Hoe which is adjacent to a small heath is notable as being one of only two localities in the county for *Cladonia cariosa*, the other being on established shingle at Snettisham. At Sparham there is a small element of normally corticolous species like *Evernia prunastri* and *Pseudevernia furfuracea* which grow on the ground amongst the moss *Polytrichum*. Elements of heathland communities are also found on abandoned railways and airfields, especially species like *Cladonia chlorophaea, C. fimbriata, C. furcata* and *Peltigera* species, though the latter are rather uncommon in *Calluna* heaths.

Grass heaths

The Breckland of south-west Norfolk and north-west Suffolk is an area of chalk covered by sands of varying depths. In places this sand cover has been removed by sand blows or by man so that a chalky rubbly soil is exposed at the surface. The soil is often extremely basic with p.H's of 7.5 or more not uncommon. These soils support a flora designated as 'Grassland A' by A. S. Watt in his studies on Breckland (Watt, 1940). This community includes an interesting assemblage of lichens, some of which do not occur elsewhere in the British Isles. Communities of this type, the *Fulgensietum fulgentis,* occur more frequently in central and southern Europe. Most of the Breckland sites for this assemblage are located in Suffolk including the best example, Lakenheath Warren. In the past there has been confusion over two other sites for vice county recording purposes. Thetford Heath though administered by the Norfolk Naturalists Trust is in the administrative county of Suffolk and the vice county of West Suffolk (v.c. 26). Thetford Warren is in the administrative county of Norfolk, but the vice county of West Suffolk. The only Norfolk site which is also in v.c. 28 is Weeting Heath.

The community at Weeting Heath is confined to the southern compartment, an area which is heavily grazed by rabbits as part of a management plan to encourage stone curlew *Burhinus oedicnemus* to breed. It has developed probably on disturbed ground as there is evidence (Crompton pers. comm.) that the area was ploughed about fifty to one hundred years ago. The lichen species which occur in this broken *Festuca ovina—Koelaria cristate* turf include *Buellia asterella* (rare), *Catapyrenium lachneum* (frequent), *Cladonia rangiformis, C. pocillum, Diploschistes muscorum* (frequent), *Squamarina lentigera* (frequent), and *Toninia caeruleonigricans* (frequent). Other species present in this community include *Bacidia muscorum, Cladonia furcata* ssp. *subrangiformis, Peltigera didactyla* (= *P. spuria*), and *Toninia lobulata*, (the latter apparently very rare). The chalk pebbles are colonised by *Petractis clausa* (rare), *Sarcogyne regularis, Verrucaria hochstetteri* and *V. muralis*. The flint pebbles have *Verrucaria nigrescens* with occasional plants of *Physcia caesia* and *Lecanora muralis*. Two notable species present at Lakenheath but absent at Weeting are *Fulgensia fulgens* and *Psora decipiens*.

It is interesting that these communities are absent from some apparently suitable areas in other parts of the Breckland such as the Stanford Army Training Area. The reasons for this may relate to past land use history and differences in soil type. In this context it is probably significant that very few of the Breckland vascular plant specialities grow there. Several old records refer to sites on Thetford Warren, now a golf course. At this locality *Squamarina lentigera* appears to have grown on the edge of old chalk quarries (Bloomfield, 1911) another indication that perhaps soil disturbance is a factor in determining of some of these species.

Coastal habitats

Norfolk has a generally low lying marshland coast with a fine series of fringing salt marshes, dunes and shingle ridges. These are best developed on the north coast, with smaller areas of shingle fringing the Wash and an extensive dune system around Winterton in the east. The cliffs at Hunstanton are composed of chalk and carstone and are too soft for any significant lichen colonisation, whilst the chalk, clay and sand cliffs between Weybourne and Happisburgh are also too soft and unstable. As a consequence the coastal lichen flora is almost exclusively one of dunes and shingle systems.

The unstable nature and high turbidity of these salt marsh coasts severely limit the intertidal lichen flora. However, flints in sheltered places on the landward side of shingle banks are sometimes colonised by *Verrucaria ditmarsica* and less often *V. maura*. They apparently prefer sites where the flints are sheltered by bushes of *Suaeda vera. Verrucaria maura* has also been found in more exposed situations on man made structures. *Arthopyrenia halodytes* is another marine lichen which is sometimes found on shells below highwater mark and is best developed on the barnacles which are attached to large flints at West Runton.

At a higher level, but within the range of spring tides there is a species-poor community characteristic of stable but rather silty shingle lows. This is best developed at Scolt Head Island and Blakeney Point and includes species like *Acarospora smaragdula, Buellia punctata, Caloplaca marina, Lecania erysibe, Lecanora atra, Physcia caesia* and *Xanthoria parietina*. Shells in these lows have species such as *Acaraspora veronensis, Caloplaca holocarpa* and *C. lactea*. The decaying rosettes of *Limonium* and *Armeria* in these areas are colonised by a number of small species like *Caloplaca citrina, C. stillicidiorum* (rarely), *Lecania erysibe* and *Lecanora dispersa* var. *zosterae. Caloplaca citrina* sometimes colonises the silty sand immediately above this zone.

Higher levels on the dunes and shingle ridges are only occasionally influenced by exceptional tides. The lichen communities are generally dominated by *Cladonia* species especially at East Hills, Wells, Blakeney Point and Winterton; though the actual species composition depends on factors such as pH. and the age of the dunes. Brown and Brown (1969) did a detailed study on the succession at Blakeney Point. The dune systems at Holme, Scolt Head Island and Holkham have a higher shell content and are therefore less acid, so the *Cladonia* communities are consequently less well developed. Species frequently found on the more acid dune systems include *Cladonia ramulosa* (= *C. anomaea), C. arbuscula, C. chlorophaea, C. ciliata* var. *tenuis, C. coccifera, C. humilis* (= *C. conoidea*), *C. fimbriata, C. portentosa, C. squamosa, Coelocaulon aculeatum, Evernia prunastri, Hypogymnia physodes, Peltigera lactucifolia* (= *P. hymenina*), *P. membranacea* and rarely *Platismatia glauca*. On the less acid dunes *Cladonia furcata* ssp. *subrangiformis, C. rangiformis, Diploschistes muscorum* and *Peltigera* species are more common.

At Gun Hill, Burnham Overy and East Hills (Wells), established shingle thinly covered by sand supports a remarkable community which is dominated by *Usnea articulata* (Fig.3) usually in association with *Polytrichum piliferum*. There are few other associated lichens, though *Bryoria fuscescens* (at East Hills), *Cladonia furcata* and *Hypogymnia physodes* also occur. *Usnea articulata* is generally thought to have south western distribution in Britain, but it is known from two sites on dunes in the Netherlands, (Sipman pers. comm.). At Blakeney Point on Yankee ridge there is rather a similar community, but while *Bryoria fuscescens* is abundant *Usnea articulata is absent. There is a record of Usnea articulata* from the Suffolk Breckland and several records of *Bryoria fuscescens* from grassland communities so it may be that such communities were formerly more widespread. Fence posts on the coast, especially those in salt marshes sometimes support an interesting flora including several species which are nationally rare. For instance, the rare eastern species *Cyphelium notarisii* occurs on fence posts in pastures near the sea, where it is found in species poor communities and may indeed be the only species present. Fences in salt marshes have a richer flora with notable species like *Cliostomum graniforme* in a community with *Caloplaca flavorubescens, Cypheliun inquinans, Diploicia*

Fig. 3 *Usnea articulata*. Gunn Hill, Burnham Overy.

canescens, Lecanora chlarotera, L. dispersa var. *zosterae, L. expallens* and *Ramalina farinacea. Xanthoria parietina* is also frequent especially in the more eutrophicated situations and is very abundant as an epiphyte on *Suaeda vera* all along the coast.

Woodlands, parklands and hedgerow trees

The lichen flora on trees in Norfolk is a relatively impoverished one compared with counties in the south and west of England. It is also clear that there has been a decline in the flora since the last century when nineteenth century records and specimens are compared with modern data. The reasons for this appear to be primarily due to air pollution, changes in agricultural practices and habitat destruction; these are discussed elsewhere in this paper. However, even when these factors are taken into consideration the flora is poor in species considered by Rose (1976) to be indicative of ancient woodlands. For instance, Norfolk is one of the few English counties from where *Lobaria pulmonaria* has never been recorded. This conspicuous species survived in Suffolk into the nineteenth century and might have been expected on biogeographical grounds to have occured in Norfolk. The fact that it was not found by lichenologists like Smith and Turner suggest that suitable habitats might have already disappeared from the county by that time and it seems likely that past woodland management practices and history have been important factors.

Rackham (1986) in his excellent paper on the ancient woods of Norfolk points out that as Norfolk was the most densely populated, prosperous and urbanised of English counties in the thirteenth century and the woods remaining then had scarcity value. Most were managed as coppice interspersed with timber trees, a method

of management which is not favourable for the growth of many woodland lichens especially those which favour ancient trees. Only rarely as at Gawdy Hall Wood do any timber trees survive to a great age. The great diversity of woodland types highlighted by Rackham is not reflected in the lichen flora which is generally confined to about twenty widespread species. However, a few woodlands do stand out as being richer than the rest, notably Swanton Novers Great Wood, and to a lesser extent, Edgefield Little Wood, Foxley Wood and Wayland Wood. Ancient woodland indicator species listed by Rose (1976) are rare or absent from these woods because their past management has been unsuitable for their development.

Wood pasture woodland is a more favourable habitat for many woodland lichens especially these ancient woodland indicator species. In this type of woodland the intention was to combine grazing with using the land as a timber resource. As these two objectives tend to conflict various practices such as pollarding were used to make them more compatible. Pollarding allows trees to continue as a timber resource even when they are old and they are therefore suitable for lichens which require ancient trees. In Norfolk most wood pastures seem to be survivors from old commons and often occur on the most infertile soil and hilliest terrains. The best example is undoubtedly Hull Wood in the parish of Saxlingham. This wood is mostly composed of ancient oak pollards some 10 metres in circumference, but also with a little ash and rowan (Lambley, 1976). The Pond Hills near Edgefield have notable hollies and rowan. There are also several woods within the parish of Thursford which probably survive from Thursford Common (Grigor, 1841) including Thursford Wood, now managed by the Norfolk Naturalists Trust. This has an area of large holly trees and also several notable hazels. Felbrigg Beeches differs from the others in that the main pollards are beech. A smaller but similar example of beech pollards occurs at Fox Hills, Northrepps.

Many of the parklands in Norfolk are eighteenth or nineteenth century in origin and generally lack the more exacting species, though sometimes good *Xanthorion* occurs. The best parklands for lichens are those with a longer history especially Blickling, Heydon, Felbrigg, Kimberley and Merton. These often have old pollards with a similar flora to those in wood pasture woodland. Other parklands which are of some interest include Barningham, Geldeston, Hilborough, Hunstanton, Letton Hall, Lexham, Narford, Pickenham, Sandringham and Westwick.

Generally hedgerow trees have a poor flora now, though the relative richness of trees within the Stanford Army Training area is an indication that such communities were probably once widespread, but have suffered, particularly from the increasing use of artificial fertilisers. Isolated trees in unimproved pasture still sometimes retain a relatively rich flora with occasionally species like *Caloplaca cerina* surviving as at Guist. Only rarely do rich communities persist in close proximity to intensive farming as at Field Barn Wighton where a rich *Xanthorion* occurs on elms bordering a large arable field.

Within these broad habitat categories it is possible to distinguish a number of characteristic communities. The dry old oak pollards in parkland and wood pasture support a lichen community described by James, Hawksworth and Rose (1977) as the *Lecanactidetum premneae*. The characteristic species of this association include *Lecanactis lyncea, L. premnea, Schismatomma decolorans* and sometimes *Enterographa crassa*. The rare species *Enterographa sorediata* may also be a member of this association. Rose listed the following species from an ancient oak at Merton Park: *Cladonia coniocrea, C. parasitica, Enterographa crassa, Lecanactis lyncea, L. premnea, Placyn-*

thiella uliginosa (= *Lecidea uliginosa*) *Chrysothrix candelaris,* (= *Lepraria candelaris*), *L. incana* and *Schismatomma decolorans*. At Felbrigg the ancient beech pollards support a poor community with *Enterographa crassa, Graphis elegans* and *Pyrenula chlorospila*. Old elms in pasture and parkland as near Hedenham Wood often support a community called the *Arthonietum impolitae,* characterised by species like *Arthonia impolita, Buellia punctata, Cliostomum griffithii, Diploicia canescens, Lecanora expallens* and *Schismatomma decolorans*. A variation of this community also sometimes occurs on rather old sycamores.

The flora of coppice woodlands is generally rather limited with the following species being the most frequent: *Arthonia radiata, A. spadicea, Buellia punctata, Cladonia coniocraea, C. macilenta, Evernia prunastri, Hypogymnia physodes, Lecanora chlarotera, L. conizaeoides, Lecidella elaeochroma, Chrysothrix candelaris, Lepraria incana, Parmelia glabratula, P. subaurifera, P. subrudecta, P. sulcata, Pertusaria amara, P. pertusa, Pyrrhospora quernea* and *Schismatomma decolorans. Lecanactis abietina* and *Parmelia caperata* also occur quite frequently.

A widespread association in the more open woodlands and parklands is the *Parmelietum revolutae* which occurs on moderately acid bark of oak, ash and sometimes elms and sycamores. The species which can occur in this community include *Evernia prunastri, Hypogymnia physodes Lecanora chlarotera, L. conizaeoides, L. expallens, Parmelia caperata, P. glabratula, P. revoluta, P. subrudecta, P. sulcata, Pertusaria amara, P. pertusa, Phlyctis argena, Pyrrhospora quernea* and *Ramalina farinacea*. This community is quite frequent for instance on ashes in broadland carrs. In less polluted sites *Pamelia perlata* also occurs. *Parmelia acetabulum* is also occasionaly found in this community as at Garboldisham where it grows on oak. Trees in pasture sometimes have elements of this and the *Xanthorion* as on an ash at Sparham where the following were recorded: *Buellia punctata, Candelariella vitellina, Diploicia canescens, Lecanora conizaeoides, L. expallens, Ochrolechia subviridis, Parmelia caperata, P. subrudecta, P. sulcata, Physcia tenella, Physconia grisea Pertusaria amara, P. coccodes* and *Ramalina farinacea*. With increasing bark acidity the *Parmelietum revolutae* tends to grade into a species poor facies of the *Pseudevernietum furfuraceae*. This could formerly be seen at Horsford, the *Pseudevernietum furfuraceae* being generally present on horizontal boughs. Species at Horsford in this community included: *Cetraria chlorophylla, Hypogymnia physodes, H. tubulosa, Parmelia saxatilis, P. sulcata Platismatia glauca, Pseudevernia furfuracea,* and *Usnea subfloridana*.

Communities where *Graphis* species are frequent are rare in Norfolk though the smooth branches and twigs of *Quercus petraea* in coppice at Swanton Novers Great Wood and Edgefield Little Wood support one. This community dominated by *Graphis elegans* sometimes with *Pertusaria leioplaca* and *Usnea subfloridana* grades in to the *Pseudevernietum furfuraceae* on rougher bark.

On damp shaded bark of ash, oak and elm in carrs and other woodland bryophyte dominated communities there occurs, with a few associated lichens like *Dimerella diluta* and *Arthonia spadicea*, the rare lichen *Ramonia chrysophaea*.

The lichen communities characteristic of enriched or eutrophicated bark, the *Xanthorion*, are frequent on hedgerow trees especially ash, elm and sycamore but are rarely well developed. One of the commonest associations is the *Buellietum punctiformis* distinguished by a species poor community comprising *Buellia punctata, Candelariella vitellina, Diploicia canescens, Lecanora chlarotera, Lecidella elaeochroma, Xanthoria parietina* and *X. candelaria*.

Physcia dominated communities are still widespread, but it is rare to find them

well developed. At Hilborough Park, Rose listed one such community on ash, comprising *Acrocordia gemmata, Anaptychia ciliaris, Buellia punctata, Calicium viride, Diploicia canescens, Lecanora expallens, Lepraria incana, Opegrapha varia, Parmelia acetabulum, P. subrudecta, P. sulcata, Pertusaria albescens* var. *corallina, Phaeophyscia orbicularis, Physcia aipolia, Physconia enteroxantha, P. grisea, Ramalina baltica,* and *Xanthoria parietina. Parmelia tiliacea* has since been recorded from this same community.

An association which is fast disappearing with the spread of Dutch Elm disease is one dominated by *Caloplaca luteoalba,* this is generally confined to wound tracks where it can dominate extensive areas of bark *Bacidia incompta* is found in a similar situation at Wighton.

Ramalina dominated communities are quite frequent on sycamore, rarely ash and elm, particularly near the sea and in other exposed situations. These include *Ramalina farinacea, R. baltica, R. lacera* (= *R. duriaei*) *R. fastigiata* and rarely *R. fraxinea.* At times this association comes close to the *Physica* dominated communities as on sycamores at Guist.

Fence posts inland generally have a very poor flora, though *Cyphelium inquinans* is not infrequent usually growing only with *Lecanora conizaeoides.* This community is distinct from *Xanthoria* dominated communities which are found in more eutrophicated situations as near farms with *Xanthoria candelaris* and *Physica* species.

The flora

A total of 349 lichen taxa and 3 allied non lichenised fungi are accepted as occuring or having occured in the county and of these 32 have not been recorded since 1960.

Geographical affinities

When the geographical affinities of the flora are examined it is not surprising that a large proportion can be placed in the broad classification of cosmopolitan. The other major elements are those with a general southern distribution in the British Isles and a south-eastern one. A small number of species appear to have a distribution centred in the north and north east of Britain. There is also the small Breckland element which is probably best placed in the general southern or south eastern groups (Coppins 1976). This analysis largely refers to lichens on trees, similar patterns can be discerned amongst lichens from other habitats.

General southern element -

Arthonia impolita, Lecanactis lyncea, L. premnea, Phlyctis agelaea (formerly), *Usnea articulata.*

General eastern -

Examples include *Anaptychia ciliaris Caloplaca luteoalba, Parmelia acetabulum* and *Pertusaria coccodes.*

South-eastern -

Extreme south-eastern species include *Cyphelium notarisii, Cliostomum graniforme* and *Lecanactis hemisphaerica.* More general south-eastern species include *Caloplaca teicholyta, Caloplaca ruderum,* and perhaps *Cyphelium inquinans* and *Cladonia glauca.* The Breckland species *Buellia asterella* and *Squamarina lentigera* perhaps belong here.

Northern or north-eastern -

Bryoria fuscescens, Cetraria pinastri C. sepincola, C. islandica, Cladonia sulphurina and *Pseudevernia furfuracea.*

The widespread element includes:

a) ubiquitous species for example *Arthonia radiata, Arthopyrenia gemmata, Cliostomum griffithii, Cetraria chlorophylla, Cladonia coniocraea, Evernia prunastri, Hypogymnia physodes, Lecanora chlarotera, L. expallens, Lecidella elaechroma, Lepraria incana, Opegrapha vulgata, O. varia., Parmelia caperata P. perlata, P. saxatilis, P. subrudecta, P. sulcata, Pertusaria amara, P. pertusa, Phlyctis argena, Platismatia glauca, Ramalina farinacea* and *Usnea subfloridana.*

b) general woodland species for example *Dimerella diluta, Graphis elegans, Opegrapha vermicellifera* and *Pertusaria leioplaca.*

c) old woodland species *Haematomma elatinum* and *Thelotrema lepadinum.*

d) species of open habitats *Caloplaca citrina, Physcia adscendens, P. aipolia P. tenella, Physconia distorta, Ramalina fastigiata, Xanthoria parietina* and *X. polycarpa.*

It is difficult to detect distribution patterns within the county except those apparently caused by air pollution and referred to earlier. There is however perhaps a submaritime element with species like *Opegrapha chevallieri, Ochrolechia parella* and perhaps some of the *Ramalina* species. *Cyphelium notarisii* also appears to belong here. The absence of *Lecanactis hemisphaerica* from churches away from the east coast is difficult to explain but it follows a similar pattern in Suffolk. It may be coincidental that all its sites lie within the area which receives an average mean duration of over 4.5 hours of bright sunshine. The Breckland species are probably restricted to the area by land use and geological factors, but it is possible that there is also a climatic element.

Changes in status

Of the 352 taxa that are accepted as having been recorded from the county 32 (9.1%) have not been found since 1960. These are considered to be extinct though it is likely that some of them will be refound in due course.

Table 3 Species considered extinct.

Aspicilia gibbosa	s.	*Lecanora populicola*	c.
Calicium abietinum	l.	*Leptogium palmatum*	t.
Calicium quercinum	l.	*Leptogium sinuatum*	s.
Caloplaca atroflava	s.	*Leptogium tenuissimum*	t.
Calopaca stillicidiorum	t.	*Moelleropsis nebulosa*	t.
Catinaria grossa	c.	*Mycocalicium parietinum*	l.
Cetraria pinastri	l.	*Pannaria leucophaea*	n.s.
Cetraria sepincola	l.	*Pannaria pezizoides*	t.
Chaenotheca chrysocephala	l.	*Parmeliopsis aleurites*	l.
Chaenotheca phaeocephala	l.	*Phlyctis agelaea*	c.
Collema cristatum	t.	*Polyblastia gelatinosa*	t.
Collema limosum	t.	*Polychidium muscicola*	t.
Coniocybe furfuracea	n.s.	*Porina borreri*	c.
Endocarpon adscendens	t.	*Psoroma hypnorum*	t.
Gyalecta geoica	t.	*Ramalina calicaris*	c.
Gyalecta jenensis	t.	*Rinodina roboris*	c.

Substrate preferences: c = corticolous, l = lignicolous, s = saxicolous, t = terricolous, n.s. = not stated.

When the flora was analysed for habitat preference it was found that a larger number of species proportionately had become extinct among those lichens growing on the ground, ie. terricolous species and those growing on wood, ie. lignicolous. The comparitive figures are shown in table 4.

Table 4 Substrate preferences.

Habitat type	corticolous		lignicolous		saxicolous		terricolous		unclassified	
	no.	%	no.	%	no.	%	no.	%	no.	%
Total Flora 352	130	39.5	18	5.1	112	31.8	72	20.5	9	2.6
Extinctions 32	6	18.8	8	25	4	12.5	12	37.5	2	6.3

It does seem that park palings, barn doors and other boarded buildings were a rich substratum up until the last century as evidenced by the collections and writings of early workers eg. Mayfield (Coppins and Lambley, 1974). It is not clear why the flora of this substrate has declined but the physical replacement of wooden gates by iron ones, and the frequent use of treated wood now in buildings and fences is probably important. Mr. Crowe's barn at Lakenham for instance must have been a fine sight with species like *Arthonia impolita* and *Cliostomum graniforme* growing on it. The best communities which survive on this substrate now are mostly near the coast.

Habitat destruction and successional changes of the vegetation are probably the prime reasons for the losses of many heath and dune lichens. In particular the Yarmouth Denes and Hemsby Marrams appear to have had some interesting species in the nineteenth century like *Psoroma hypnorum* and *Pannaria pezizoides*. These habitats were presumably destroyed during the development of Yarmouth in the nineteenth and twentieth centuries. Habitat destruction and perhaps afforestation may explain the loss of other species like *Moelleropsis nebulosa*.

Whilst relatively few lichens have become extinct many more have declined both in abundance and luxuriance. This is particularly noteworthy with many of the species associated with the *Xanthorion*. Collections of species like *Anaptychia ciliaris* and *Ramalina fraxinea* from the nineteenth century show well developed specimens which are often abundantly fertile. References to them in the floras usually refer to them as being 'common'. This is not true now, both *Anaptychia ciliaris* and *Ramalina fraxinea* are rarely found fruiting and *Ramalina fraxinea* in particular looks very stunted. The *Xanthorion* is now becoming a relict community and many of the more exacting species are likely to become extinct or nearly so in the next few decades. The species which are perhaps most at risk include: *Anaptychia ciliaris, Bacidia incompta, B. phacodes, B. rubella, Caloplaca cerina, C. luteoalba, Gyalecta truncigena, Parmelia tiliacea, Physcia aipolia* and *Ramalina fraxinea*. The factors which have caused this decline are probably several and include increased air pollution, Dutch elm disease and the widespread use of artifical fertilisers at the expense of animal manures. Most remaining *Xanthorion* communities survive in parkland and are dependent on the maintenance of traditional management practices.

Changes have been noted in other lichen communities on trees even within the last 15 years. Formerly rich communities on oaks at Horsford and to a lesser extent Bylaugh have become poorer with species like *Parmelia caperata* (Fig. 4), *P. perlata*

Fig. 4 *Parmelia caperata.* Horsford.

and *Usnea intexta* dying. In these sites agricultural practices are not implicated and the cause appears consistent with damage due to high sulphur dioxide levels or increased acidification of bark due to acid rain. In other parts of the county it is often difficult to ascertain whether air pollution or agricultural chemicals are more important. In this context it is perhaps significant that relatively rich lichen communities remain in the Stanford Army Training Area, where agricultural chemicals are little used and sheep farming is the main agricultural activity.

There seems little change in the status of most lichens growing on stonework, especially in country churchyards. However, there are some lichens growing on stone which appear to have increased, these include *Lecanora muralis, Parmelia mougeotii, P. verruculifera, Stereocaulon nanodes, Rhizocarpon geographicum* and *Xanthoria elegans. Parmeliopsis ambigua* is a corticolous species which may also have become more common, though less dramatically than elsewhere in the country. The most spectacular increase of all as elsewhere, is the spread of *Lecanora conizaeoides* not known in the county in the nineteenth century and first recorded on birch and pine in the mid 1930's. It is apparently absent from specimens collected on other bark substrates at that time.

Acknowledgements
Many people have helped me over the years in my study of the lichens of the county. However I would particularly like to mention Dr Francis Rose for his encouragement, help with identifications and for commenting on the systematic list. Dr Christopher Hitch also commented on the systematic list and has been helpful in many other ways. Dr Brian Coppins, Peter James and Jack Laundon have identified many specimens. I would also like to thank the land owners who have given me permission to visit their land and Samuel Manning for allowing access to the Kirby Trimmer collection.

References

BLOOMFIELD, E. N. 1905 Lichens in Norfolk and Suffolk. *Trans. Norfolk Norwich Nat. Soc.* **8**, 117-137.

BROWN, D. H. & BROWN, R. M. 1968 The Lichens of Blakeney Point, Norfolk. *Lichenologist* **4**, 1-15.

BROWN, D. H. & BROWN, R. M. 1969 Lichen communities at Blakeney Point, Norfolk. *Trans. Norfolk Norwich Nat. Soc.* **21**, 235-250.

CANNON, P. F., HAWKSWORTH, D. L. & SHERWOOD-PIKE, M.A. 1985 *The British Ascomycotina. An anotated checklist.* Kew: Commonwealth Mycological Institute.

COPPINS, B. J. & LAMBLEY, P. W. 1974 Changes in the lichen flora of the parish of Mendlesham, Suffolk during the last fifty years. *Trans. Suffolk Nat. Soc.* **16**, 319-335.

CROMBIE, J. M. 1901 Lichenes (Lichens) In *The Victoria History of the Counties of England, Norfolk.* (H. A. Doubleday ed.) **1**: 70-72 Westminster: Constable.

DRUREY, J. H. 1829 *Historical and Topographical notice of Great Yarmouth.* London: Nichols. (Lichens 379-381 by D. Turner).

ELLIS, E. A. 1934 Wheatfen Broad, Surlingham. *Trans. Norfolk Norwich Nat. Soc.* **13**, 422-451.

ELLIS, E. A. 1960 The Lichens. In *Scolt Head Island* (J. A. Steers ed.) 177-178 Cambridge: Heffers.

GELDART, A. M. 1914 Sir James Edward Smith and some of his friends. *Trans. Norfolk Norwich Nat. Soc.* **9**, 645-692.

GRIGOR, J. 1841 *Eastern Arboretum* London: Longman, Brown, Green & Longmans.

JAMES, P. W. 1973 The effect of air pollutants other than hydrogen fluoride and sulphur dioxide on lichens. In *Air pollution and Lichens,* 143-175 London: Athlone Press of the University of London.

JAMES, P. W., HAWKSWORTH, D. L. & ROSE, F. 1977 Lichen communities in the British Isles. In *Lichen Ecology* (M. R. D. Seaward ed.). Academic Press.

HAWKSWORTH, D. L. & ROSE, F. 1970 Quantitive scale for estimating sulphur dioxide air pollution in England and Wales using epiphytic lichens. *Nature* **227**, 145-148.

HAWKSWORTH, D. L. & SEAWARD, M. R. D. 1977 *Lichenology in the British Isles 1568-1975,* Richmond Publishing Company.

KNIGHT, H. H. 1935 Norfolk Lichens. *Trans. Brit. Mycol. Soc.* **20**, 15-16.

LAMBLEY, P. W. 1973 Lichens on Marsham Heath *Trans. Norfolk Norwich Nat. Soc.* **22**, 439.

LAMBLEY, P. W. 1973 Hull Wood. *Trans. Norfolk Norwich Nat. Soc.* **22**, 439-440.

LAUNDON, J. R. 1970 Lichens new to the British Flora: 4. *Lichenologist* **4**, 297-308.

MANNING, S. A. 1937 Fauna and flora of Norfolk. Lichens. *Trans. Norfolk Norwich Nat. Soc.* **14**, 303-308.

MANNING, S. A. 1944 The natural history of Wheatfen Broad, Surlingham Part VI: Lichens. *Trans. Norfolk Norwich Nat. Soc.* **15**, 420-422.

MANNING, S. A. 1960 New, rare and critical Norfolk lichens-I. *Trans. Norfolk Norwich Nat. Soc.* **19**, 65-68.

MANNING, S. A. 1960 New, rare and critical Norfolk lichens-II. *Trans. Norfolk Norwich Nat. Soc.* **19**, 168-172.

MANNING, S. A. 1983 The lean years—4. *British Lichen Soc. Bulletin* no. 52.

MCLEAN, R. C. 1915 The ecology of maritime lichens at Blakeney Point. *J. Ecol.* **3**, 129-

PAGET, C. J. & PAGET, J. 1834 *Sketch of the Natural History of Yarmouth and its neighbourhood.* F. Skill and Quay.

PEVSNER, N. B. L. 1962a *North-east Norfolk and Norwich* Harmondsworth: Penguin (Buildings of England).

PEVSNER, N. B. L. 1962b *North-west and south Norfolk* Harmondsworth: Penguin (Buildings of England).

RICHARDS, P. W. M. 1929 Notes on the ecology of the bryophytes and lichens at Blakeney Point, Norfolk. *J. Ecol.* **17**, 127-140.

RACKHAM, O. 1986 The Ancient woods of Norfolk. *Trans. Norfolk Norwich Nat. Soc.* **27**, 161-177.

ROSE, F. 1976 Lichenological indicators of age and environmental continuity in woodlands. *In Lichenology Progress and Problems* 297-307. Systematics Association Special Volume no. 8 Academic Press.

SMITH, J. E. & SOWERBY, J. 1790-1814 *English Botany.* London: J. Sowerby.

TURNER, D. & BORRER, L. W. 1805 *The Botanists Guide through England and Wales.* 2vols. London: Phillips and Fardon.

WATT, A. S. 1940 Studies in the ecology of Breckland IV. The grass-heath. *J. Ecol.* **28**: 42-70.

(The second part of this paper — A systematic list of Norfolk lichens — will appear in these *Transactions* in 1989. — ed.)

THE WORK OF WALTER LOWNE, TAXIDERMIST OF GREAT YARMOUTH

P. A. Morris

West Mains, Ascot, Berkshire, SL5 7DG.

Introduction

It is not easy to discover details of the day to day work of minor 19th century tradesmen and craftsmen. This is particularly true for those like taxidermists who were once to be found in every town, but whose trade disappeared almost entirely in the middle years of this century. The old taxidermists provided a service for collectors, naturalists, sportsmen and the general public, sometimes for several decades in the same place; yet they often operated as a one-man business and kept no records of their transactions. They were frequently well known locally among their actual and potential clientele and so did not bother to issue price lists or catalogues to solicit business. Some taxidermists were also of a secretive disposition and probably disinclined to discuss their business affairs with others. Consequently we know very little indeed about the life and works of even the most famous of the old taxidermists who were familiar names a hundred years ago. Often a taxidermist's work has survived, identified by an attached trade label or highly distinctive style, but nothing at all is known about the man himself or the business he transacted.

The present paper reviews what is known about Walter Lowne (1854-1915), taxidermist of Great Yarmouth, and his work. It is based principally on three documents described below, of which the ledger is almost unique in offering a detailed insight into the work and income of a small-town taxidermist over a period of 26 years. This and the record book, were saved from a 'rag shop' during the First World War, where they had been sent to be pulped after Lowne's death. They were found there by Arthur H. Patterson, the well-known Norfolk author and columnist who wrote under the name 'John Knowlittle'.

Sources of information

(a) The Ledger of Walter Lowne

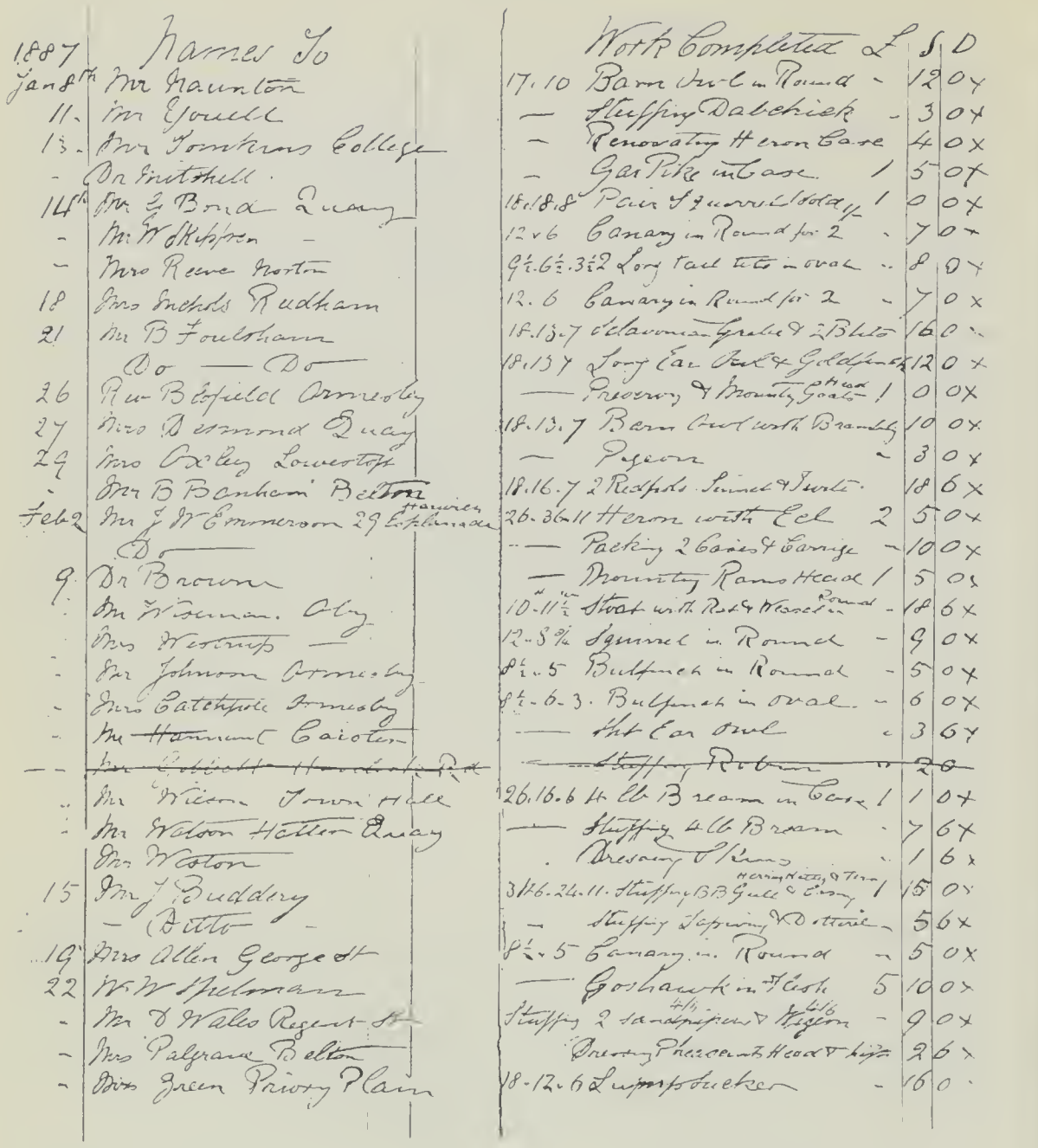
This is a workbook in which Lowne recorded all the jobs for which he was paid, from 1886 to 1911 inclusive. The date, customer's name and price charged was noted, together with the name of the animal(s) he preserved and dimensions of the glass case in which many of the specimens were mounted (Fig. 1). The book was made up daily or at very short intervals. Some entries are vague (eg "gull"), others are deleted and it is not clear whether this reflects work that was not paid for or never actually done. It is sometimes unclear whether a new bird was being set up in a case or merely a case being built for an existing specimen.

This document was given by A. H. Patterson to P. E. Rumbelow. He gave it to the late Robin Harrison of Great Yarmouth in 1954, who kindly allowed the author to copy it in 1986. The original is still owned by Mrs Harrison. A photocopy will be deposited in the Norwich Public Library Archive, another is in the author's own collection.

(b) 'The Record Book of Walter Lowne, bird stuffer of Fuller's Hill'

Thus titled by A. H. Patterson this is a small lined book (10 x 16cm) of 70pp. The

Trans. Norfolk Norwich Nat. Soc.
1988 **28**(1), 33-44.



1887	Names &c	Work Completed	£	S	D
Jan 8th	Mr Haunton	17.10 Barn Owl in Round		12	0 x
11.	Mr Yorrell	— Stuffing Dabchick		3	0 x
13.	Mrs Tomkins College	— Renovating Heron Case		4	0 x
	Dr Smithett	— Gar Pike in Case	1	5	0 x
14th	Mr E Bond Quay	18.18.8 Pair of squirrels Stoffed	1	0	0 x
—	Mr W Hopkins —	12 v 6 Canary in Round for 2		7	0 x
—	Mrs Reeve Norton	9½.6½.3½2 Long tail tits in oval		8	0 x
18	Mrs Nichols Rudham	12. 6 Canary in Round for 2		7	0 x
21	Mr B Foulsham	18.13.7 Adavonian Grebe & 2 Blues		16	0 x
	Do — Do	18.13.7 Long Eared Owl & Goldfinch		12	0 x
26	Rev Bloefield Ormesby	— Freeswy & Mountg Goats Head	1	0	0 x
27	Mrs Desmond Quay	18.13.7 Barn Owl with Mounting		10	0 x
29	Mrs Oxley Lowestoft	— Pigeon		3	0 x
	Mr B Banham Belton	18.16.7 2 Redpoles Stuffed & Mounted		18	6 x
Feb 2	Mr J W Emmerson 29 Esplanade Hamilton	26.36.11 Heron with Eel	2	5	0 x
	Do	— Packing 2 Cases & Carriage		10	0 x
9	Dr Brown	— Mounting Ram's Head	1	5	0 x
	Mr Wiseman. Ely	10"-11½" Stoat with Rat & Weasel in Round		18	6 x
	Mrs Westrup —	12-8¾ Squirrel in Round		9	0 x
	Dr Johnson Ormesby	8½.5 Bullfinch in Round		5	0 x
	Mrs Catchpole Ormesby	8½.6.3. Bullfinch in oval		6	0 x
	Mr Hammant Caistor	— Hat Ear Owl		3	6 x
	~~Mrs Cobbold Hamilton Rd~~	— ~~Stuffing Robin~~		~~2~~	~~0~~
	Mr Wilson Town Hall	26.16.6 4 lb Bream in Case	1	1	0 x
	Mr Watson Hatter Quay	— Stuffing 4 lb Bream		7	6 x
	Mr Watson	Dressing 2 Rams		1	6 x
15	Mr J Buddery	31/46.24.11. Stuffing BB Gull & Herring Hatty & Tern & Curry	1	15	0 x
	— Bittern —	— Stuffing Sapsing & Dottrel		5	6 x
19	Mrs Allen George St	9½.5 Canary in Round		5	0 x
22	W W Spelman	— Goshawk in Flesh	5	10	0 x
—	Mr D Wallis Regent St	Stuffing 2 sandpipers & Wigeon 4/6 4/6		9	0 x
—	Mrs Palgrave Belton	Dressing Pheasants Head & Legs		2	6 x
—	Miss Green Priory Plain	18-12-6 2 Lapwings Sucker		16	0 x

Fig. 1 A page from the ledger of Walter Lowne. The date is followed by the customer's name, the dimensions of the case, the work done and the price charged.

original is in the Archive section of the Norwich Public Library (MS no. 4185). It lists in date order, a selection of the more notable bird specimens that passed through Lowne's hands (or were seen by him) 1878-1893 inclusive. There are about 20 entries per year, including many that do not appear in the ledger, perhaps because they were sold in the flesh to others or perhaps never bought by Lowne at all. A few have buying prices indicated by the prefix 'B', 14 of which also show the selling price ('S'), in many other cases only one or other is given; the majority have no information on prices given. The locality and collector/source of each bird is also noted as 'where taken' and 'who by'. A few pages record prizes won at local cage bird shows, also some addresses. The title and a few annotations are in A. H. Patterson's handwriting.

(c) 'A short Biography of Walter Lowne (1854-1915) Taxidermist'
This quarto sized manuscript by A. H. Patterson comprises 28 pages of handwritten reminiscences about Lowne and (even more) the local bird catchers of Great Yarmouth. There are extensive extracts from Lowne's record book (above), though the ledger is not mentioned. An additional 11 pages contain newspaper cuttings and illustrations referring to cage birds kept by Lowne. The original document now belongs to a private collector of Patterson's work; a photocopy is in the author's collection.

These documents are referred to as (a), (b) and (c) below and are the principal sources from which the present paper has been derived. Prices given in this paper are in pounds, shillings and old pence, as in the original documents.

Walter Lowne: personal details

Arthur Patterson knew Lowne having lived in an adjoining house for some years (c), but never learned anything of his boyhood save that he was always keenly interested in birds. Lowne was born in 1854 in Martham (Norfolk) and served his apprenticeship there. He then moved to Great Yarmouth 15km away to take up work as a carpenter and remained there until his death on 17 January 1915. In his early twenties, Lowne decided to take up taxidermy in his spare time. Patterson gave him a book on the subject and Lowne had a local bird stuffer named Juler set up a cuckoo for him. This was speedily dismantled to reveal its secrets, and by 1878 Lowne was selling mounted birds (b). He worked from a garden shed, (probably at 23, Caister Road; see fig. 2) until 1881 when he took over Watson's game dealer's shop at 40, Fullers Hill. Lowne is listed at this address in Trade Directories 1883-1916 and it is given on his death certificate. The shop was well placed on a main road, between the game dealer's stalls in the market and Breydon Water, twin sources of so many of his specimens. Patterson noted in (b) "Walter and I went in for stuffing together. He sat at it all night, frequently after a day's work as a carpenter. I foolishly went courting. We each excelled in our own way. He made a living of stuffing; I got an excellent wife." In fact Lowne also married, and his wife Hannah Mary, two years his junior, outlived him by 29 years. They are buried together in Belton Churchyard, close to Great Yarmouth. No photographs or other documents relating to Lowne have been traced, nor does Patterson give any more information in his many books on rural life in Norfolk.

Lowne died relatively young (aged 62) and was evidently in poor health for many years. His record book (b) is increasingly truncated after 'an illness' is given as the

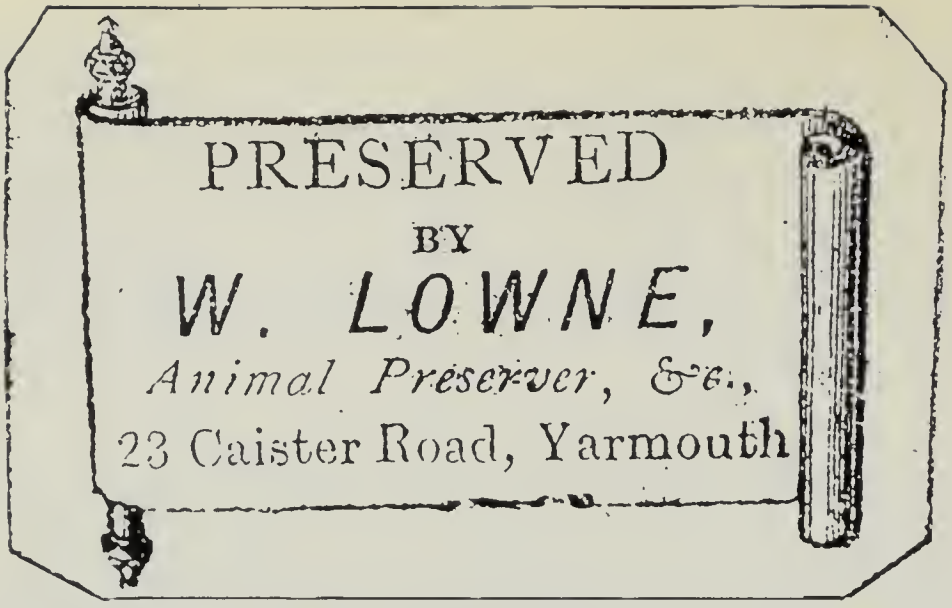


Fig. 2 Early trade label of Walter Lowne. (Black print on blue/green paper.)

entry for 1897. There was only one record noted in 1901 and none for 1900 or 1902. Similarly his ledger (a) shows an average of 188 jobs completed per year, declining in 1908 and 1909 and dropping sharply to 90 in 1910 and 74 in 1911 when the ledger ceases. His last record (b) was of a glossy ibis at Acle in October 1913, followed by a note by Patterson "In these lean years poor old Lowne was frequently ill. He used arsenic for preservative rather carelessly and probably his *illnesses were* (my italics) due to this and his entire collapse." Lowne's death certificate records 'chronic nephritis' as the cause. It should be noted that many contemporary taxidermists lived at least 10 years longer than he did, despite similar exposure to arsenic. Patterson also refers to several 'strokes'; the 'last attack of which was 1915' (c).

Patterson described Lowne as being of cheerful and optimistic disposition but somewhat dogmatic. He was a large man, above average height and inclined to stoutness. He was a keen angler, secretary of a local club for many years and won prizes for large catches and specimen fish (c). His association with anglers was doubtless good for business and he mounted 595 freshwater fish in 26 years (a).

He was also an enthusiastic and accomplished aviculturalist. He won prizes for cage birds and ornamental fowl at national and many local shows and was sometimes appointed a judge. He was particularly noted for skill in raising and keeping 'difficult' birds (eg. shorelarks, nightingales; kingfishers and bearded tits were raised even from nestlings and were special favourites). He does not appear to have contributed to scientific publications (apart from short articles on buntings in avicultural magazines) but submitted brief observations to the local Press on notable species brought in for preservation.

A note by Patterson (b) indicates that Ted Knights worked as an assistant to Lowne in 1895. This was probably J. E. Knights who was in business on his own account (though not listed in Trade Directories) in 1922. A printed trade label of that date on a case of sanderlings in the Norwich Castle Museum gives his address as 87 Churchill Road and previously 14 Beconsfield Road, North Denes, Great Yarmouth. Other taxidermists contemporary with Lowne, included Ed. Lighton listed in Trade Directories (1908-1933) and G. Smith & Son (1890-1892); at least two more

are mentioned by Patterson but not listed in Directories (Ben Dye & 'Harvey'). E. C. Saunders, another Yarmouth taxidermist, was in business later, (1925-1937). In addition there were others contemporary with Lowne nearby in Lowestoft: James Bull, (1888-1892) and Howard Bunn, (1888-1916); two more in Beccles (W. Gent, 1904-1933; Robert Tilney & Son, 1888-1892), more in Norwich only 30km away and still others elsewhere within 80km. Inevitably there was rivalry, leading to some minor 'sharp practices', described by Patterson, and efforts by the wildfowlers to play off one taxidermist against another to get the best price for a rare bird.

Most of Lowne's customers (a) were local, though he also dispatched to addresses in London, Surrey and Calafornia (*sic.*). He sent a penguin to Woking, and in 1908 supplied birds to the famous London collector J. B. Nicholls who was somewhat overcharged. Lowne also had a note (b) of the address of A. F. Griffith (taxidermist at the Booth Museum, Brighton) to whom he sent a rough-legged buzzard, waxwing and great snipe "in the flesh". There is no evidence in documents, contemporary accounts or on trade labels, that Lowne dealt in birds' eggs, as did many other taxidermists. Patterson says Lowne had a small collection of mounted birds, but this was not a private museum, more a temporary repository for rarities which he had bought speculatively and hoped to sell.

The Birds

In 26 years (1886-1911), Lowne's ledger records that he handled a minimum of 4,784 birds, an average of 184 per year. Critics (see below) might assume this to be a heavy drain on local populations, but in fact 22% were domestic species (including 431 canaries). Altogether he prepared specimens of at least 206 wild bird species, handling an average of 55 species each year. Many specimens, even of the wild species, were aviary reared birds, presumably including at least some of the 383 kingfishers he prepared. Nevertheless Lowne also prepared what today seems an astonishing number of owls (459), including at least 173 barn owls and 94 long-eared owls (many others, simply recorded as 'owls' could have been these species too). Similarly, birds of prey were popular with his customers and Lowne prepared at least 213 of them (including 90 kestrels, 29 harriers, 2 goshawks, 7 merlins, 12 rough-legged but only 3 common buzzards, 2 honey buzzards, 9 peregrines; also hobby and "orange-legged hobby" possibly a red-footed falcon). However in some years he handled no birds of prey at all and in total they comprised only 4% of his avian output. Positioned between the sea and great Norfolk wetlands, it is not surprising that Lowne's birds included 202 ducks (though only representing 4% of his total birds). He was also well placed for vagrants of Continental origin (spoonbills, 2 x golden oriole, 3 x glossy ibis) and 423 seabirds (9% of total birds). In the 26 years he recorded 45 herons, 30 bitterns (especially obtained in cold winters) and 15 red-backed shrikes. Several species were handled regularly (in at least 20 of the 26 years) e.g. bullfinch, goldfinch, kingfisher, little grebe, pheasant, woodcock, heron, jay, kestrel, sparrowhawk. Certain species were handled only once, being very scarce (e.g. little bustard, grosbeak, Iceland gull, purple heron, nutcracker). Some occurred only rarely (e.g. avocet in 2 years, little bittern in 3, snow bunting in 5) because they were and are, uncommon. Fulmars were handled in only 1895 and 1898, probably reflecting their scarcity as British birds at that time (they are common on the Norfolk coast now). His first preserved little owl was not until 1900, again because this relatively recently introduced species had not yet become so widespread as it is now. Con-

versely, corncrakes, referred to as 'land rails'; were handled in 13 years but are now very rare due to changed farming practices. The infrequent occurrence of dipper, red grouse (in 2 years each) no doubt reflects the fact that they are not normally associated with this part of Britain, but the apparent scarcity of locally common species handled in only 1 or 2 of the 26 years (e.g. reed bunting, brent goose, meadow pipit, reed warbler) must mean that they were regarded as uninteresting and not worth bothering about. Similarly, Lowne records no examples of blackcap, chiffchaff, many other common warblers or sandwich terns; all of which would have been very abundant locally. He preserved few geese, probably because most were shot for eating and few people wanted such bulky specimens. Swans were also not much in demand, though one job comprised "2 head necks in glass case". There is some indication that Lowne mounted birds from previously-prepared cabinet skins e.g. a January (1897) swallow and June (1886) redwings. Some species treated in this paper as 'domestic' were actually foreign species bought in as skins or obtained from a menagerie. He also remounted badly stuffed specimens, presumably originally set up by someone else.

Many of the birds are referred to by obsolete vernacular names e.g. 'land rail', 'bullie' (Hett, 1902). Frequent reference to 'mule' (cross between a canary and a wild finch species) is further evidence of his avicultural activities. Similarly preserving a 'nun' probably referred to a species of Indian mannikin (*Munia* sp.) from his aviary rather than a member of the local convent.

He handled white, black, fawn or piebald specimens of 14 bird species:

sparrow—one white, two pied, one 'curious'.
blackbird—two pied, two fawn.
skylark—one black, one white, one pied.
pheasant—three white, two piebald.
house martin—one white.
linnet—one white.
swallow—one white.
woodcock—one white.
goldfinch—one white.
greenfinch—one white.
redpoll—one fawn.
lapwing—two fawn.
yellowhammer—one ('variety') also variety mallard (one).

There were also two four legged chicks, a four and a five legged duckling and a six legged kitten.

At the turn of the century, it was fashionable to use a decorative screen to hide unused domestic fireplaces during the summer. These were usually about 1m tall often consisting of a framed picture or embroidery, supported on legs. Taxidermists' catalogues show that the glass frame could be made to contain an assortment of colourful birds or a single bird. In the latter case it was usually an owl or heron, with the wings spread and fastened vertically behind the bird's body. Sometimes these distorted apparitions were not protected by glass and few examples survived half a century of dusting and vacuum cleaning.

Lowne prepared 72 of these firescreens, 20 of them featuring a heron (priced at a guinea each), but only one bittern. Twenty eight were made with owls, 17 with gulls; kestrels, a jay and a (sparrow?)hawk were used in the others.

Lowne was active at a time when birds were in fashion as embellishments for

ladies hats (Doughty, 1975). Contemporary campaigns against the use of birds in the millinery trade, leading to the formation of what became the RSPB, and the popular writings of W. H. Hudson and others, seem not to have damaged this aspect of his business. Some of his hats seem especially bizarre—three orders were for woodpeckers; pheasant heads were popular as were terns (including three on one hat and another displayed with a cuckoo). Dunlin, snipe, swallow, nightjar, goldcrests (two on one hat), starling, bearded tit (two on one hat), "goldfinch & c" greenfinch and blue tits, jay wings and head, were all used. It is difficult to understand how one of his customers could wear a parrot on her hat; another ordered a budgerigar for a hat (or maybe supplied her own late companion?).

The commonest millinery order was for kingfishers. Thirteen were supplied (including one with a fish). Some of these birds were no doubt local, but others may have been bought in as skins. Lowne records his use of skins bought from dealers (e.g. humming birds) and 50,000 kingfisher skins were sold in three English sales in 1906 & 1907, so there was no shortage of material (Doughty, 1975).

The Fish

Preserving trout as a client's souvenir of a day's skilful flyfishing was a regular source of income for many taxidermists but salmonids comprised only 2% of all the fish prepared by Lowne. Not surprisingly, the common coarse fish, more typical of his local waters, predominated. Roach, rudd, bream and perch made up three quarters of his fish work. The 83 pike that passed through his hands mostly weighed less than 20lb, perhaps because Norfolk waters were not a source of larger pike or perhaps because trophy specimens and record fish were customarily sent to a major taxidermist, like John Cooper of London, with a reputation for specialising in fish. Several of the pike were mounted as heads only including one in an unusual octagonal case. Only three eels figured among Lowne's 595 freshwater fish, but these are not normally popular as trophies or attractive specimens. More surprisingly, there were only seven carp. The single Zander probably reflects its relatively recent introduction to Britain in 1878 (Lever, 1977).

All the fish were cased, often with curved glass, a fashionable way of displaying fish, costing substantially more than plain glass. Some were furnished with a gilt line around the edge of the glass. Fish cases were among Lowne's more expensive productions, many costing over £1 and large pike up to £4. In all he prepared 402 cases of fish in 26 years, an average of 15.5 a year, usually done in batches. This was probably for convenience and also perhaps dictated by fishing seasons. Often rudd and roach especially were cased together, perhaps as a record of a day's fishing.

Being based at a seaport with an active fishing fleet, Lowne might have prepared more marine fish. In fact he listed (a) only 23 specimens of 14 species. These included a lamprey, a small shark, a cod head, a flying fish (source not clear) and a sturgeon. Curiously there were six lumpsuckers, a species which is both unattractive and unexpected along the sandy East Anglian coast.

The Mammals etc

Between 1886-1911, Lowne preserved 578 mammal specimens, excluding items used as prey for owls. As with his bird taxidermy, a substantial proportion of the jobs (22% of mammal specimens) involved domestic and zoo species. Of the 451 *wild* mammals, red squirrels accounted for 46%, stoats and weasels jointly comprised 15%. The few foxes (4 whole, 6 heads & 8 skins) formed only 4% of his mammal

work, whereas for most taxidermists, mounting fox-hunting trophies is a major element of reliable business. The wet pastures of eastern Norfolk were probably poorly suited to foxes and huntsmen alike. Hares too were commonly prepared by taxidermists, but Lowne handled only 11 (plus 8 skins and many 'pads'). It is no surprise that 10% of Lowne's wild mammals (48) were otters. Most of these were probably shot or trapped (especially by water bailiffs), road casualties being unlikely at that time. A customer with a local address brought in a polecat in 1904, perhaps one of the last found in Norfolk as this species was extinct there soon after (Langley & Yalden, 1977). No fewer than 18 bats were preserved by Lowne for his customers, though the appeal of such specimens is difficult to see; similarly the 35 moles he mounted (9% of all his wild mammal specimens). These were in addition to the more understandable, if tedious, job of 'dressing' 384 mole skins in 1908 (for £4) and another 300 in 1910. Eight of the moles were interesting, being white; 4 of them came from the same area (Mautby) 6km NW of Yarmouth. One of these, mounted in a glass case in 1905 for five shillings is now in the author's collection. The other wild mammals set up by Lowne included (only) eight hedgehogs, 13 rabbits and a few deer heads (red, fallow & roe). The 'domestic' species included 52 dogs of many breeds, often as heads only. One was recorded thus: "King Charles as rug". There were 18 cats (plus one tail), five guinea pigs, two mice, 30 farm animals (mostly as heads including a "cow head for Bishop Fisher"), three ferrets, four monkeys, five marmozet (*sic*) and three mongoose. These last items must have come from a zoo or possibly seamen in port. More extraordinary are the walrus head, beaver, raccoon and porcupine. His six seals may have been local ones which breed on nearby Scroby Sands.

Lowne charged for three hooves, one as "horse hoof inkstand", a type of tasteless curio often prepared by taxidermists. He also supplied "cow's heart in round" (dome) and two bear feet. A 'two headed calf' and a 'malformed calf head' were no doubt from a local farm. His biggest job (apart from articulating a whale skeleton for the local museum) was a Shetland pony for which he charged £3-15-0d. Occasional fox brushes and "horns mounted" are not included in this analysis of Lowne's work. An alligator, two tortoises, a salamander, four lobsters, nine snakes, four spider crabs, a sea mouse, a "Norway shrimp" (?*Nephrops*) add to the diversity of his products; the single porpoise he mounted probably convinced everyone that these animals are not suitable for the taxidermist's skills.

Albinos and other colour variants were prized by collectors, so any available specimens were likely to be passed to the local taxidermist. Apart from the eight white moles mentioned above, Lowne had no variant mammals though he did record four white stoats (two of them as early as October, in 1898 and 1902).

Sources of specimens

It is unlikely that Lowne did much collecting himself. He bought a gun licence in 1880, but obtained little on his forays (c), and probably was too busy for much shooting. A substantial proportion of Lowne's work comprised domestic species, including many birds that were presumably from his own aviaries where he also kept and bred various wild species. A lot of the birds and mammals listed in his ledger (a) were brought to him by members of the public to be mounted (c). These doubtless included shot and trapped specimens, but also birds which he recorded (b) as killed by the newly-erected telephone wires. It is possible that some of his suppliers were less than honest, perhaps wishing to conceal acts of trespass. For

example it is difficult to believe the record (b,c) of 15 common buzzards washed up on the beach, though an abundance of little auks in winter 1894-5 and 1900-01 correspond to a note in the logbook (b) 'severe weather' and widespread 'wrecks' of this species noted elsewhere (Fisher & Lockley, 1954). Some specimens were brought from elsewhere (e.g. five bluethroats from Cley, costing 8/1d in 1883) and many skins came from other dealers. He prepared at least seven "albertross", possibly brought to Great Yarmouth by seamen as souvenirs from the Southern Hemisphere.

Many of Lowne's specimens were bought from friends in the country (c) as speculative purchases. Many more came from Durrant's famous game stall in Yarmouth, including a peregrine in 1882 and spotted crake in 1884. Patterson (1904) recorded that Durrant's stall held over 900 birds on 16th December 1899, and was a favourite place to look for unrecognised rarities among the common waders. Lowne also obtained from fishermen birds collected at sea, including rarities such as glaucous gulls and Richardson's (arctic) skua, but also (supposedly) a goshawk and a golden oriole. There was evidently considerable competitiveness and some sharp practice among the buyers and sellers of dead birds, described in several of Patterson's books (Frost, 1987).

Patterson often referred to the activities of a group of bird catchers who used snares and clap nets on the dunes north of Yarmouth to catch migrant birds for the London market (Frost, 1987). Lowne evidently received live specimens for his aviaries from this source and, in turn, supplied mounted birds "for decoys" (a); a linnet in 1907, a duck 1908 and a wood pigeon in 1909.

According to Patterson (1904), local wildfowlers would get 4d-6d for a fresh kingfisher, Lowne charged two shillings for one mounted on a perch. Rarer specimens permitted a larger mark-up (especially if the shooter or game dealer did not recognise a rarity for what it was). A fawn blackbird Lowne bought for 2/- was sold for 20/-. The prices Lowne paid were sometimes noted in his record book (b), e.g. 6d for a black redstart (1891) and 2/6d for a velvet scoter. In a few cases (14 species) he also noted the selling price, typically 2-4 times as much, but he did not indicate when the latter included the cost of a case.

Workload and Income

Lowne completed 4,881 jobs (many of them comprising more than one item) in 26 years, an average of 188 per year. He also did small carpentry jobs (e.g. building glass cases for models) and sold glass domes for clocks, adding to his income. At the back of the ledger (a) are notes of jobs done off the premises, particularly renovating other people's collections and building museum cases on site. Many of these jobs were only carpentry, but collectively they evidently earned a useful amount. In 1891 he attended to the collection of 'Sir S. B. Crossley Bart' for six days, charging for "self and man and railway" £1-3-8d per day, plus half a gallon of benzoline at 4/- (for cleaning & fumigating). He renovated Mr Corkhill's whale (£1-5-4d for 38 hours, plus 15/- for expenses and materials). Griffin & Myhill are referred to as assistants, the latter evidently helping to build a rock scene for an eagle group in "Foulsham Case". Myhill's time was charged at 9d per hour, Lowne's at one shilling.

Apart from 1909 & 1911, during presumed illness, Lowne's yearly income varied between £97 and £220, averaging £155 p.a. excluding work done off the premises. This represents about £3 per week, double that associated with 'solid working class comfort' and well into the income range of skilled tradesmen in the 1890's (Burnett,

1969). However, recorded payments to Lowne (a) had to cover his expenses too, so his actual income was less than the gross totals given. His prices were stable, e.g. two shillings to mount a canary, throughout the period 1886-1911 (equivalent to the cost of lb of tea). Simply preparing a cabinet skin of a small passerine cost 9d. Setting it up on a perch cost 2/- but for building the glass case Lowne charged more than for his taxidermy, reflecting the extra time that good carpentry took (even when he used ready-made soap or borax boxes). For example 'stuffing owl' cost 3/6d. In a glass case the price was 10/- and with glass end panels (abbreviated 'GE' in his ledger), 11/6d. A tinted background or 'water scene' (for ducks) cost a shilling more. He charged three shillings for "stuffing squirrel", and 7/6d. for setting it in a case. For building a case for a squirrel that was already done he charged 6/-. Fish were always more expensive, typically £3-£4 for a 15lb pike. Curved glass fronts were more costly than plain glass; gold edging added further to the expense.

He used glass fronted, glass ended, glass topped and all glass cases; even the occasional diamond shape or octagon. Lowne dealt in various manufactured items, especially glass domes, of which he sold a total of 751 (mostly round, some oval a few square—reflecting their relative scarcity and price). Being a carpenter he was perhaps better able to vary the design and size of his glass cases (in contrast with the standard 'formula' type cases built by Gunn of Norwich). The groundwork was usually of peat covered paper painted brown with green 'highlights', similar to the style of other Norfolk taxidermists. He often incorporated abundant dried moss and green painted sprigs of vegetation and painted inside the case a deep sky blue (occasionally attempting a pink 'sunset' tint). Often a gilt frame ('GF' in his ledger) was inserted behind the glass; taxidermists usually used gilt strips (if at all) on the outside of the glass to hold it in place. On the back of the case was fixed Lowne's trade label featuring symbols representing a medal he won for a group of birds in 1881. At least three variants, differing slightly in the typeface, were used until at least 1888. By 1905 he had changed to a square label showing the medal and an avocet (Fig. 3). Despite adopting this bird as his emblem, Lowne prepared very few of them.

Lowne's cases generally appeared neat, pretty and decorative, their main purpose though with scant regard for botanical exactitude, as was normal in this type of work. The quality of his taxidermy varied considerably. Some of his birds are neatly finished and, for their period, better than average in terms of lifelike appearance. However, other specimens are very crude and most are very static and 'wooden' in attitude, reflecting an unimaginative approach to taxidermy common at that time. X-rays of extant bird specimens suggest that he used a mass of tow, tightly bound with thread to form the body, with a central wire pushed in from the rear and out the top of the head. This and the two leg wires (with sharpened ends, pushed up the legs from the feet) were doubled over and bent into the body. The tail was supported on a separate wire, and the wings (at least in birds up to the size of a teal) were not wired but simply pinned in place. Examples of Lowne's mammal specimens are less often seen today.

Discussion

Although some British taxidermists were in business for many decades, few detailed records of their work have survived. Ledgers from the Sheals brothers of Belfast have been preserved, also some incomplete trading records of E. C. Saunders (Great Yarmouth) and possibly one Scottish taxidermist. Occasional descriptions of taxidermists, their work and prices appear in the 19th century literature and some of

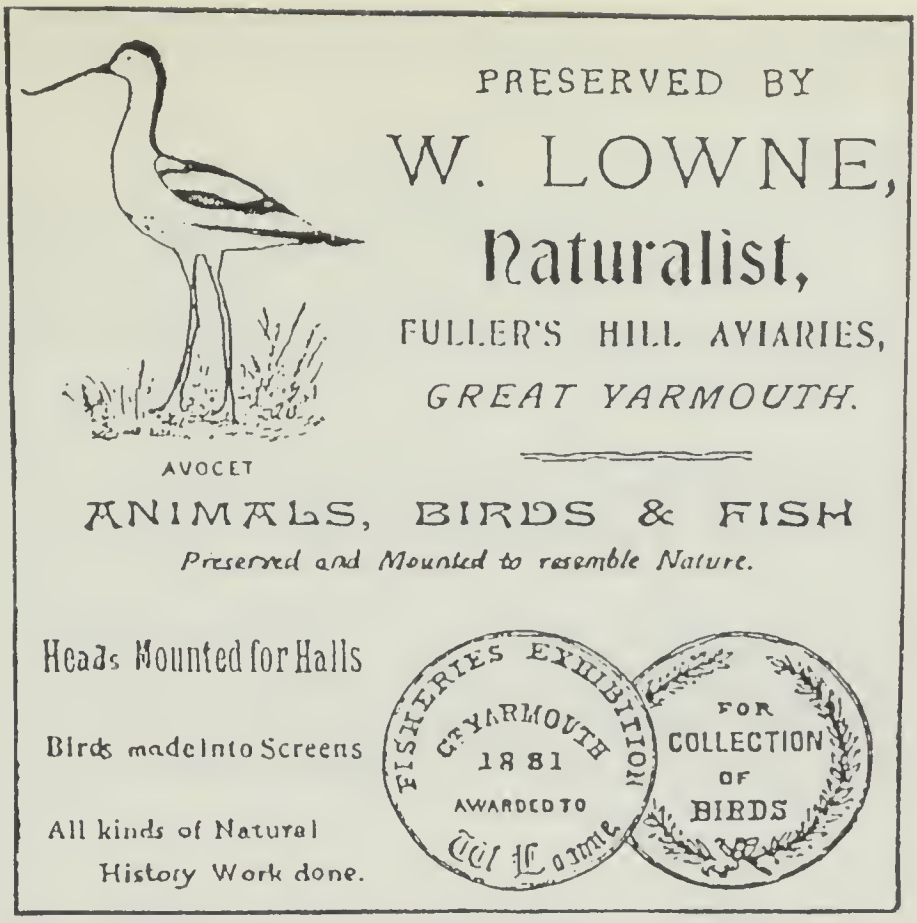


Fig. 3 Lowne's avocet label in use at the turn of the century.

the major firms published price lists and catalogues. However, none of these documents offer such an insight into the actual work done by the typical taxidermist as we now have for Walter Lowne.

Perhaps the most significant revelation is the very large proportion of his work that comprised domestic animals. Even though he lived and worked in a faunistically rich area, at a time of great enthusiasm among dedicated collectors, over 20% of Lowne's birds and mammals were domestic in origin. He may have been atypical among taxidermists in maintaining an active avicultural enterprise, providing many specimens. Nevertheless, his ledgers offer little evidence to support the sometimes virulent condemnation of taxidermists as being responsible for persecution of rare and predatory species (Nicholson, 1926). In Lowne's case at least, it is obvious that he collected little himself and was only one of many local tradesmen (including the game dealers) who paid for specimens brought in by professional wildfowlers. Though not unknown among some of the more ruthless bird collectors, Lowne did not act as a major agent for any of them. The list of customer's names in his ledger offers no evidence that he was retained by any regular collector, nor that he profitted from excessive collecting zeal on the part of any particular individuals as did George Bristow of St. Leonards-on-Sea for example, (Nicholson et al, 1962).

The surviving documents relating to Lowne and reviewed here suggest that he was a hard working, well known local craftsman, keenly interested in birds, but

without scientific aspirations or national prominence. As such, he must have been very typical of the many hundreds of British taxidermists who prospered in the years between 1850 and 1950.

Acknowledgements

I am very grateful to the late Robin Harrison for so generously allowing me to borrow and copy Lowne's ledger and Patterson's biography; documents regarded as precious heirlooms. As a keen observer and chronicler of Norfolk wildlife & social history he would have welcomed the use to which his documents have been put and I am saddened by the fact that he died only a few months before a draft of this paper was available.

I also acknowledge the help given me by Christopher Frost and John Goldsmith; the former for showing me an article by "Robin" which first indicated that further information about Walter Lowne might exist and the latter for helping me trace its author.

References

BURNETT, J. 1969 *The History of the Cost of Living* Penguin: London.
DOUGHTY, R. W. 1975 *Feather Fashion and Bird Preservation* University of California Press: Berkeley.
FISHER, J. & LOCKLEY, R. M. 1954 *Sea Birds* Collins: London.
FROST, C. C. 1987 *The History of British Taxidermy* The Author: Long Melford.
HETT, C. L. 1902 *A Glossary of Popular, Local and old fashioned Names of British Birds* Sotheran: London.
LANGLEY, P. J. W. & YALDEN, D. W. 1977 The Decline of the Rarer Carnivores in Britain during the Nineteenth Century *Mammal Review* **1**, 95-116.
LEVER, C. 1977 *The Naturalised Animals of the British Isles* Hutchinson: London.
NICHOLSON, E. M. 1926 *Birds in England* Chapman & Hall: London.
NICHOLSON, E. M. & FERGUSON-LEES, I. J. 1962 The Hastings Rarities *British Birds* **55**, 299-345.
PATTERSON, A. H. 1904 *Notes of an East Coast Naturalist* Methuen: London.

THE GREAT STORM OF 1987

G. M. Haggett

Meadow End, Northacre, Caston, Norfolk.

The storm of October 16th 1987 was the most violent in modern times. It was not just the sheer power of winds up to 100 miles per hour but the capricious local turbulence that caused such destruction. The disturbed air moved into Britain from the English Channel and ravaged town and country from Sussex and Kent through the eastern counties and out into the North Sea from Norfolk. A broad swathe of destruction ran from Newmarket and Bury St. Edmunds through West Harling to Norwich and on to Cromer, while the coastal belt suffered turmoil as rampaging winds exploded to the sea. Nowhere escaped within that area although the extreme west and northwest of Norfolk experienced relative calm.

It was dawn when the storm raged into Norfolk and for four hours human activity was reduced to emergency services. The previous summer and autumn had been one of constant rainfall with heavy deluge preceding the storm itself; ground conditions were as wet and saturated as they were ever likely to be in October, foliage still full and heavy in the absence of frosts, fruit copious and yet to fall. In these conditions trees presented the most unstable targets, their roots without firm grip and their crowns heavily laden. They simply keeled over in the face of the onslaught or, where they clung to what footholds they were lucky enough to have, they were savaged beyond recognition, their limbs stripped and their crowns ravaged or their stems snapped.

Site and species determined the pattern of tree blow or damage in relation to the local topography and momentum within the hurricane; trees of shallow roots, of impeded root development whether on chalk or clay, these were the most susceptible. So sweet chestnut, beech, birch, lime and most conifers and especially where open grown, were the earliest casualties. Diseased, damaged or aged stems were obvious targets and with them went the nesting places and dead wood invertebrate habitats of long standing. The apparent haphazard selection of tree victims was to be explained by their individual condition, age, species and site position in relation to the storm velocity and direction, as was the direction of fall which although principally to the north and east showed plenty also to the west. Few species could be said to be totally resistant to such force but given comparable condition of site over a big enough area it could be seen that sweet chestnut and beech were plucked from oak mixtures, and that Corsican pine in plantations went down before Scots pine. In the urban scene where trees are so subject to root disturbance only the common plane in Norwich stood while all manner of other species were blown around them.

Contrary to common belief rural oaks fared no better than other trees, indeed they were frequently the biggest contributors to wayside debris. Their crowns and foliage were the heaviest and so presented the most solid resistance. Being still the most common of wayside trees they have been those most subject to man's damage, whether by disturbed water table, severed roots, soil compaction or sheer physical disfigurement. And being long-lived they have been ridden by rot and disease. Add to that a common imbalance of root spread, often on drain or dyke-side, and we see how sadly ready set-up they were for such a disaster. But it was the destruction of oak crowns that caught the eye, for the bulk of foliage and giant limbs strewn over field and roadway came from this species. Again many of the limbs showed internal decay at both branch junction and trunk but the very sturdiness and rigidity of oak branches and crowns put them at disadvantage in winds of such frightful force.

In the woods damage was generally less severe being limited to scattered isolated taller trees, woodland edges, ridesides, or to trees on waterlogged patches. Younger plantations suffered principally in the Norwich area and at West Harling, and especially where selective thinning had been done within the year, but nowhere in Norfolk was there windblown comparable with that of the King's block in the Suffolk end of Thetford forest, or the still worse carnage that befell Rendlesham forest on the Suffolk coast. Plantations of well-grown poplar were badly hit everywhere being snapped at midpoint.

In open country the trail of destruction ran through roadsides taking trees on rises, clumps and banks, the familiar and the well-loved, the oldest and the best preserved.

The effect on wildlife will not be known for many years. For the great majority of animals there may be benefit for newly created habitat and especially small mammal and reptile niches. Certainly woodland ground flora is expected to show grand displays and species renaissance in the short term, while all manner of fungi will expand to occupy a grossly extended food source. It is the tree and hole nesting birds and bats that are likely to be most adversely affected but no known heronry has been lost.

Ecologists and students of woodland succession have an unrivalled opportunity to monitor the pattern of floristic change on a range of sites although in Norfolk the few ancient woodlands have not been so badly hit as in southern counties.

THE MARINE FAUNA OF THE NORTH NORFOLK SALT MARSHES, AND THEIR ECOLOGY

C. L. J. Frid

School of Biological Sciences, University of East Anglia, Norwich

Introduction

The salt marshes and coastal mudflats of north Norfolk are world famous for their bird life (Tate, 1977). These areas are also renowned for their striking flora and range of insect species. Along the northern coast of Norfolk offshore sand and shingle banks protect much of the coast from wave action, thus allowing the development of extensive intertidal sand and mudflats and marine marshes (Ranwell, 1972). The salt marshes of the north Norfolk coast are the best examples of coastal saltmarsh in Britain, and one of the best in Europe (Jefferies, 1977) and this is recognized by the designation of the whole coast as a series of nature reserves, with the exception of a narrow strip at the entrance to Wells Harbour.

The lower or submergent marsh, that covered by most tides, has a flora dominated by the pioneer species *Salicornia europaea*, known locally as 'Samphire', the sea aster (*Aster tripolium*) and cord grass (*Spartina* spp.). *Spartina* is a perennial and its dead stems remain present throughout the year. *Salicornia* however, is an annual which covers extensive areas in late spring and summer, before dying back each autumn after setting seed, the areas it covers reverting to unvegetated mud in the winter. This plant material is consumed directly by birds, but most of it is broken away by storms and wave action and enters the coastal food web. Its importance to this system is highlighted by Nixon and Oviatt (1975) who calculated that over 25% of the biological production in a coastal bay in New England was based on material washed in from adjacent salt marshes.

The upper or emergent marsh is only submerged by the highest spring tides, and has a more diverse flora including many long-lived herbacious perennials (Jefferies, 1977). The common salt marsh grass, *Puccinella maritima*, grows in the higher parts of the submergent marsh spreading up into the emergent marsh where it occurs with the sea arrow-grass (*Triglochin maritima*). Also occurring in the emergent marsh are sea plantain (*Plantago maritima*), sea thrift (*Armeria maritima*), seablite (*Suaeda* spp.), sea purslane (*Halimione portulacoides*) and the sea lavenders (*Limonium* spp.)

In addition to the flowering plants, seaweeds and various green algae grow in the pools and on the submergent marsh. These marine algae contribute 30% by weight to the total annual crop at Stiffkey. Measurements made at Stiffkey indicate that as much as half the total annual crop of the marsh is removed by the tides, to either enter the coastal ecosystem or to be washed up to produce a strandline habitat.

Five broad habitats can be recognized within the marsh: (i) unvegetated areas, (ii) vegetated mud, (iii) areas of exposed glacial gravels, (iv) salt pans/pools and (v) creeks, although many species of animal occur in more than one habitat. Some of these habitats can be seen in Fig. 1. However the fauna can be conveniently divided into two groups, those present at all states of the tide and those only present at certain tidal states. The latter group consist of fish and birds, while the former are mainly invertebrate. These marine invertebrates play a major role in converting detritus produced from the plant material into food for the fish and birds, and in

Trans. Norfolk Norwich Nat. Soc.
1988 **28**(1), 46-50.

Fig. 1 The marsh offers a range of topographically distinct habitats. In the foreground of this view are areas of vegetated mud, a salt pan and unvegetated mud (extreme right). Beyond the pool is a small area of exposed glacial gravels and a creek system.

recycling the nutrients which are essential to the flowering plants.

The fauna

The marine invertebrate fauna of the north Norfolk salt marshes was sampled at monthly intervals from January 1985 to December 1986. These data combined with occasional records made during this period form the basis of this discussion.

The fauna of the north Norfolk salt marshes contains species from at least eight major phyla. A full species list and voucher specimens are lodged at Norwich Castle Museum. Here I shall briefly review the main species present and their ecology. For a discussion of the taxomony of the Norfolk marine fauna see Hamond (1963, 1966).

Unvegetated mud

Unvegetated mud is relatively uncommon on the emergent marsh, but when *Salicornia* dies back large areas are exposed on the submergent marsh. The fauna is numerically dominated by worms living within the sediment — the infauna. This

consists predominantly of oligochaetes, especially *Peloscolex* spp. and members of the families Tubificidae and Enchytraeidae, nematodes and polychaetes such as *Captitella capitata* (Fabricus) and *Scoloplos arminger* (Muller). These mainly feed by unselectively ingesting particles of organic matter and detritus from which the microspic decomposers are stripped.

Passage through the worm's gut breaks the material down physically and speeds subsequent recolonization and breakdown by microscopic organisms after it is egested. The polychaete worms *Nereis* (the ragworm) and *Nephtys* (the white rag or catworm) are infaunal predators, stalking their prey through the sediment or scavenging on large particles of organic matter. Low on the submergent marsh polychaetes dominate, but on the high submergent marsh and on the emergent marsh the oligochaetes are more numerous.

The infauna are for the most part inconspicuous, while the surface living forms are more easily observed. Numerically dominant amongst the surface forms is the mudsnail (*Hydrobia ulvae* (Pennant)) for which densities as high as 16,000 m^{-2} have been recorded (Table 1). *Hydrobia* is a surface deposit feeder, ingesting small particles of organic matter from the very top layer of the sediment. It also ingests free-living diatoms and diatoms attached to large sand particles.

Actively roaming over the marsh surface in summer are small shore crabs (*Carcinus maenas* (L.)) known locally as 'gillies'. The crabs act as general scavengers throughout the marsh, feeding on carrion, detrital particles, detached pieces of plant material and by predation of the fauna.

Vegetated mud

The emergent marsh is covered by an extensive range of plant species, thereby offering a range of microhabits for invertebrates. The roots of this vegetation makes burrowing difficult for the larger species, so the infauna is therefore dominated by small oligochaetes.

On the submergent marsh where conditions are damper, and salinity variation is more predictable, polychaetes such as *Capitella* and small oligochaetes dominate. *Hydrobia ulvae* occurs on the mud surface as a deposit feeder, but also makes excursions up the stems of plants grazing on the algal film which coats the vegetation. Between tides on the submergent marsh the vegetation acts as a blanket trapping a damp atmosphere close to the mud surface. During the summer, small *Carcinus* make use of this to extend their foraging period, and often do so in great numbers (Table 1).

Glacial gravels

Many of the salt marshes of the north Norfolk coast have developed on glacial shingle deposits and in places these come to the surface to form areas of large stones with muddy material between them. A number of species more typical of rocky shores take advantage of these areas.

The mud surrounding the large stones has a fauna similar to that of unvegetated mud, although the presence of the stones reduces the abundance of individuals. The stones support large numbers of the periwinkle (*Littorina littorea* (L.)). *Littorina* can feed either as a surface deposit feeder on the mud, or by grazing the microscopic algae growing on the stones. The chiton *Lepidochitona cinereus* (L.) also feeds by grazing the algal covering on the stones.

Table 1: Major components of the marine fauna, their season and location of maximum abundance between January 1985 and December 1986.

(UM = upper marsh, MM = mid marsh, LM = lower marsh)

Species	Maximum abundance 1985-86 no. m^{-2}	Month of, and habitat of maximum abundance	
Hydrobia ulvae	16296	July	LM vegetation
Capitella capitata	3420	June	MM vegetation
Arenicola marina	40	May	UM pool
Littorina littorea	409	August	MM gravel
Carcinus maenas	236	May	LM pool
Palaemon spp.	180	October	UM pool
Macoma balthica	352	May	LM creek
Total Nematodes	13921	September	UM pool
Nephthys spp.	189	May	MM pool
Total Oligochaetes	19692	April	LM vegetation
Pomatoschistus minutus	60	November	UM pool

Salt pans and pools

The pools and salt pans of the marsh provide an aquatic refuge at low tide. However they are isolated from the sea, so that evaporation during the summer and dilution by rain cause extreme variation in the salinity of the pools. Organisms using pools as refuges therefore need to withstand these changes in salinity. During the summer juvenile mullet (*Chelon* spp.) use the pools as nursery grounds, as do small flatfish, plaice and flounders (*Pleuronectes* spp.). Prawns (mainly *Palaemon* spp.) and small gobiid fish, such as the sand goby (*Pomatoschistus minutus* (Pallas)) move on shore in spring and spend the summer and autumn on the marsh before migrating offshore for the winter. The prawns are generalist scavengers taking carrion, dead algae and small infauna when they can. The gobies are predatory, taking copepods and mysids (planktonic crustaceans) and infaunal worms. In those pools with sandy bottoms, the shrimp *Crangon crangon* (L.) replaces the prawns as the main scavenger.

The amphipod *Orchestia gammarella* (Pallas) is widely distributed over the marsh, occurring amongst the algae of the pool edges, in the algae on the strandline and on the vegetation. *Orchestia* is a scavenger, especially of cast-up seaweeds but it will also graze living plant material.

The infauna of pools is usually similar to that of the surrounding marsh, with the addition of the lugworm (*Arenicola marina* (L.)). *Arenicola* lives in a J-shaped burrow, and ingests large volumes of sediment from which it digests out the organic matter before reversing up its burrow to egest the sediment as a conspicuous cast.

Salt marsh creeks

The water flowing in the creeks is replenished each tide, and therefore shows much less salinity variation than the pools. The fauna of the creeks differs from that of the pools. Small gobiid fish and prawns are rare, this is probably the result of increased predation by fish moving up the creeks on the flood tide.

The infauna of the creeks is dominated by the polychaetes *Capitella*, *Scoloplos*, *Nereis* and *Nephthys*, which all occur in the unvegetated mud of the submergent marsh, and additionally the surface deposit feeding polychaetes *Pectinaria koreni* (Malngren) and *Amphitrite johnstoni* (Malngren) occur. The small bivalve mollusc *Macoma balthica* (L.) also occurs in the creeks, feeding on surface deposits by means of its prehensile siphon.

The invertebrate fauna of the north Norfolk coast is diverse, and plays a major role in recycling nutrients, as well as acting as the food source of many species of coastal fish and birds. Yet in spite of nature reserve status the area is beginning to suffer at the hands of man. Increased pressure from bait digging, both amateur and professional, is having a significant effect not just on the bait worms but the whole infauna (Jackson and James, 1979). While our knowledge of the ecology of these creatures is rudimentary, there is considerable scope for the keen amateur to contribute to our understanding and protection of these habitats.

References

HAMOND, R. 1963. A preliminary report on the marine fauna of the north Norfolk coast. *Trans. Norfolk Norwich Nat. Soc.* **20**(1), 2-3.

HAMOND, R. 1966 The polychaeta of the coast of Norfolk. *Cah. d. Biologie Mar.* **7**, 383-436.

JACKSON, M. L. & JAMES, R. 1979. The influence of bait digging on cockle, *Cerastoderma edule*, populations in north Norfolk. *J. appl. Ecol.* **16**, 671-679.

JEFFERIES, R. L. 1977. The north Norfolk coast in *Nature in Norfolk. A heritage in trust.* (ed.) R. Washbourn. Norwich: Jarrold, pp. 130-138.

NIXON, S. W. & OVIATT, C. A. 1973. Ecology of New England salt marsh. *Ecol. Monogr.* **43**, 463-498.

RANWELL, D. S. 1972. *Ecology of salt marshes and sand dunes.* London: Chapman & Hall.

TATE, P. (1977) *East Anglia and its Birds.* Witherby.

THE CURRENT STATUS OF THE SEA ANEMONE *NEMATOSTELLA VECTENSIS* IN ENGLAND—A CORRECTION—In a recent paper published in *Trans. Norfolk Norwich Nat. Soc.* **27** (5), pp.371-374 (1987), a Norfolk record of *Nematostella vectensis* from the Stiffkey Marshes communicated to me by Miss C. Burgoyne of the University of East Anglia was noted. At the time of being notified of this record, which I accepted in good faith, I did not see any specimens. Just before publication of my paper, an editorial decision was made to include a photograph by Mr M. Hardy of an anemone collected by Miss Burgoyne from Stiffkey and purported to be *N. vectensis* (Fig. 1). Unfortunately I did not see this photograph before publication.

On receipt of the published version of my paper, I immediately recognized that Fig. 1 was, in fact, a young specimen of *Sagartia troglodytes* var. *ornata*, an anemone common on Norfolk coasts. Subsequently, the editor kindly sent me the whole series of photographs (previously unknown to me) of Miss Burgoyne's Stiffkey anemones which all proved to be *S. troglodytes*. The Stiffkey record of *N. vectensis* is therefore shown to be erroneous and Fig. 1 of my paper is unfortunately incorrectly labelled and is irrelevant. *Cf.* Fig. 2

R. B. WILLIAMS, Norfolk House, Western Road, Tring, Herts.

THE DISTRIBUTION AND STATUS OF LIZARDS IN NORFOLK

John Buckley

77 Janson Road, Southampton.

Introduction

Three lizards are native to England but one of these, the sand lizard *Lacerta agilis* (Linn.), is not found in Norfolk (Buckley, 1975). It is now confined to lowland heaths in the south of the country and sand dunes in Lancashire. The common lizard *Lacerta vivipara* (Jacquin) and the slow worm *Anguis fragilis* (Linn.) are well within their geographical range in Norfolk and found throughout the county.

The maps presented in this paper show the distribution of Norfolk's lizards on a tetrad basis for the first time and it is hoped that they will act as a stimulus for further recording. The paper also provides information for interested persons to be able to find and identify lizards within the county.

Identification and habits

The lizards show more diversity of form than any of the other groups of reptile. They can be readily distinguished from snakes only by their moveable eyelids, external ear openings, notched, not deeply forked tongues, and lower jaws which are firmly fixed. Lizards also lack the broad ventral scales characteristic of most snakes.

The common lizard and slow worm belong to different families and look very different. The common lizard is a fairly typical member of the Lacertidae having a comparatively short body, distinct head and long tail (Fig. 1). The limbs are well developed and project more or less sideways from the body as far as the elbows and knees. Five digits with claws are found on each limb. The slow worm, a member of the Anguidae, shows the body form typical of the family. It has a long body and fairly long tail. Neither the head nor the tail are distinctly set off from the body nor are there visible traces of limbs (Fig. 2). Having a snake-like form, its method of locomotion is similar to that used by most snakes.

Both the slow worm and the common lizard have the ability to shed their tail voluntarily when this is seized by a predator. This self-fracture or autotomy is brought about by the sudden contraction of muscles which split a vertebra at a special plane of weakness. Normally the tail fractures at the point at which it is seized. The autotomised tail flexes back and forth vigorously for several minutes to distract the predator whilst the lizard is able to escape. The vertebrae at the base of the tail lack the special plane of weakness and this part cannot be autotomised.

After fracture a new tail end is formed in the course of a few months. The regenerated section is not the same as the original. A rod of cartilage replaces the original vertebrae and it does not grow to the full length. The scales are less pigmented on the new section of tail and the original pattern is not continued onto it. It is always possible to recognise a regenerated tail unless it was shed when the lizard was very young. The slow worm's ability to regenerate its tail is less than that of the common lizard and a short blunt tail results.

Both species are ovoviviparous which means that the female retains the eggs inside her body until they are due to hatch. Pregnant females spend much of their time basking, and the eggs develop more rapidly than they would if buried in the ground. Upon being laid the young lizard soon breaks free of the membranous egg shell. In general ovoviviparous species have been able to extend their range farther north than oviparous (egg laying) species.

Trans. Norfolk Norwich Nat. Soc.
1988 **28**(1), 51-61.

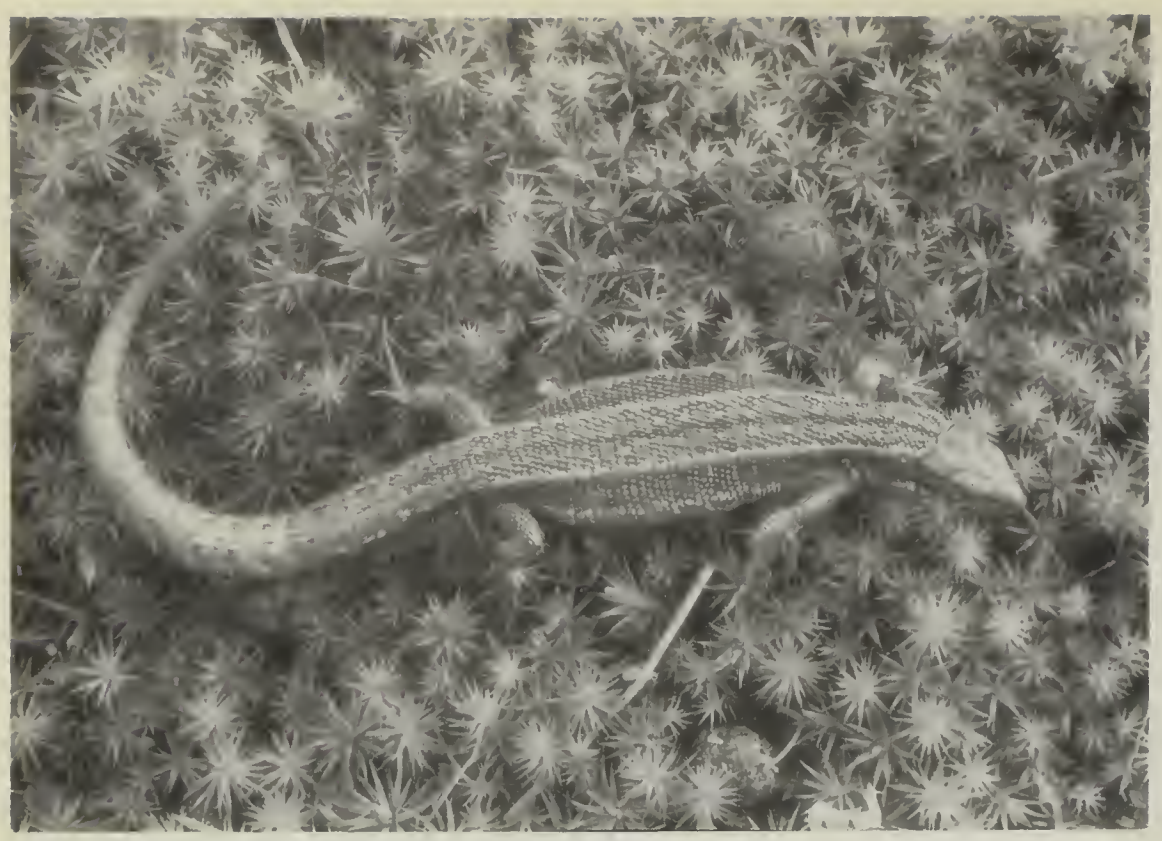


Fig. 1 Common lizard female. Cranford Heath, Dorset.

Lizards, like snakes, shed the outer layer of their skin several times a year and it is relatively easy to identify a slough. In the common lizard the skin is shed in pieces sometimes as large as to include the whole body except for the head, limbs and tail. Skin from the dorsal part of the body can be recognised by the pattern of light and dark markings which have the same distribution as on the animal but are less distinct. Portions of the belly slough can be recognised by the rectangular appearance of the scales.

The slow worm casts its skin rather like a snake but rarely does the slough come away in one piece. As the slow worm moves forward, the skin normally concertinas to form thick rings which are characteristic of this species. Fragments of slough, and these rings, if gently pulled apart, reveal the almost uniform shape and size of the slow worm's scales over the entire body.

The sloughs of common lizard may be found towards the base of heather stems in suitable habitat and beneath pieces of fallen wood, bark and rubbish. Slow worm sloughs are found in the base of dense vegetation, in the surface peat and under natural and discarded objects such as wood, plastic, scrap metal or fabric.

The common lizard may reach a length of about 180 mm (7 inches) but most specimens are shorter, about 140 mm (5 inches). The ground colour of the dorsal surface is variable. Adults may be brown, yellowish, reddish, greyish or greenish. Darker and lighter markings are longitudinally arranged. There is usually a dark vertebral stripe, more or less entire, extending from the back of the head to the base of the tail, and a broad dark lateral band on each side of it extending the whole

length of the body. These are edged above and below with yellowish or whitish lines, which are continued in a series of light spots along each side of the tail. The narrow light lines between the vertebral and lateral stripes may be uniform in colour or flecked. In the male the pattern of darker markings is less distinct than in females. The two sexes differ in belly coloration. That of the male is orange or vermillion thickly spotted with black. The female has a pale orange, yellowish or whitish underside with a few spots or none at all. Males can be identified without handling by the swollen base of their tail where the penes are located. The ground colour of the young is black, blackish bronze or dark brown with the adult markings faintly discernable as a golden or dirty yellowish outline.

The general biology of this lizard is described in Smith (1951), Simms (1970), Street (1979) and Frazer (1983). It occupies a wide variety of habitats in Britain being found on commons, moorland, heaths, meadows, boglands, hedgerows, grassy banks, the borders of woods, forest clearings and sunny glades. It does not avoid damp habitats. In coastal regions it inhabits sand dunes and rocky or chalk cliffs. It is found beside country paths and roads, beside old walls and fences, on railway embankments, and stone quarries and in rubbish dumps. Unlike some lizards found on mainland Europe it does not penetrate far into villages and towns (Street, 1979).

It has a preferred body temperature of about 30°C and basks to achieve this temperature. During springtime, basking individuals may readily be seen on a favourite sun trap with their bodies flattened and tilted towards the sun. A log, stone or base of a tree, a pile of brushwood, or a clearing amidst thick vegetation may provide a suitable basking site. When disturbed the lizard makes off into the undergrowth in a series of abrupt dashes and brief pauses. When the danger appears to have passed, it returns to its original basking spot or one nearby.

Mating takes place in April or May and the young are born between late June and early September, but usually at the end of July. The usual number of young is 5 to 8 and rarely up to 15. In one study of 50 females, the mean clutch size was 7.7, range 3-11 (Avery, 1975). The length at birth is about 40 mm. At the beginning of autumn the common lizards retreat into suitable holes in the ground and crevices amid the roots of vegetation to hibernate. Table 1 suggests an active period from early/mid April to late September early October in most years. Warm weather during the winter may tempt out some individuals and bring forward the date of emergence.

Table 1 The number of sightings of lizards per month (data from all years 1970-1987).

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Common lizard	0	0	2	40	25	28	41	58	19	6	0	0
Slow worm	0	0	0	14	16	14	15	14	7	2	0	0

The slow worm may reach a length of about 500 mm (20 inches), but it is usually less. The tail when complete is slightly longer than the head and body together. Smith (1985) found that autotomy had occurred in 50% of adults and 20% of juveniles at his study sites and therefore snout to vent length is probably a more useful measurement for comparing the size of individuals than total length.

When adult, the two sexes are readily distinguishable from one another by colour and pattern. The dorsal colour of males is grey, lead grey, grey brown, light brown, dark brown, brick red, copper or bronze. The sides are similar to the top

Fig. 2 Slow worm female. New Forest, Hants.

of the back and the underside is thickly mottled dark grey on a lighter background. The vertebral stripe, present in the young, usually fades in the adult and may be absent especially on the tail.

Females are usually light or dark brown, brick red, copper or tan on top. The dark vertebral stripe is often, though not always retained. The sides are very dark brown or black becoming lighter towards the belly and head. The underside is black.

Newly born slow worms are pale golden brown, light yellow, cream, sometimes copper or silvery grey above with black sides and a black underside. There is a black V or dot on the back of the head which continues as a thin vertebral stripe to the tip of the tail (Fig. 3).

Some specimens, usually males, develop blue spots which vary in size and abundance in different individuals. They range in size from tiny flecks to the size of a whole scale and in colour from pale to dark blue. Their distribution is more or less irregular on the top of the back particularly on the anterior part.

The general biology of this lizard is described in Smith (1951), Simms (1970), Street (1979 and Frazer (1983). Useful data are also provided by Smith (1985). In Britain the slow worm occupies a variety of habitats. It is found on commons, meadows, heathland, hedgerows, the edges of woods and in sunny glades, and on railway embankments. Often it occurs in areas associated with human activity such as sand and stone quarries, chalk pits, rubbish tips, disused farmland, gardens, churchyards and cemeteries.

The slow worm is not usually found basking except in the early morning and in the spring; more often it lies under an object such as a flat stone, log, piece of

Fig. 3 Recently born slow worm. New Forest, Hants.

bark, pile of rock, or discarded piece of sheet metal, to warm up. In late summer however pregnant females are often to be found lying out in the sunshine. Individuals may also be found roaming about in the early evening. Slow worms like to burrow in light soil and may be spotted almost totally concealed amongst material at the base of vegetation. Smith (1985) recorded an average body temperature of 26°C in the period June to August, slightly lower than values obtained for the common lizard. Table 1 suggests an active period from April to early October in Norfolk.

Mating takes place in April, May or early June and the young are born between the end of August and mid-September depending upon the quality of the summer. Smith (1985) gives an average litter size of 8.2 (range 1-18). The average head and body length at birth is about 45 mm. Male slow worms reach maturity in their third or fourth year and females a year or so later.

Slow worms hibernate in the second half of October depending to some extent upon the weather. They select crevices in banks and amongst the roots of bushes and hedgerows, under piles of leaves or wood, under heaps of stone or rubble, or they may make their own hole. They may hibernate singly or in groups. In the springtime the males and juveniles appear before the females.

Recent records and distribution

Records sent to the society by members and others since 1960 have been copied onto edge notched cards for ease of storage and retrieval. Post 1970 records have been plotted as tetrad (2 km x 2 km square) maps. There has been no systematic

Fig. 4 Common lizard. Tetrad distribution map showing post-1970 records.

Fig. 5 Slow worm. Tetrad distribution map showing post-1970 records.

attempt to survey areas for lizards and to some extent the distribution shown by the maps may reflect the activities of recorders. There is certainly scope for our knowledge of the species, distribution to be extended and updated. Doubtful and unconfirmed records have been omitted from the maps together with some where the precise locality could not be determined. Full details have been supplied to the Biological Records Centre at Monks Wood and to the data bank at the Castle Museum, Norwich.

The common lizard is the most widespread reptile in the county, but there are some 10 km squares in which it has yet to be recorded, (Fig.4). Unlike the other species it is found at sites along the north coast in West Norfolk. It is likely to occur wherever there is suitable habitat. Table 1 suggests that April to July and August are the peak times for recording this species and visits to likely areas during suitable weather could extend the known distribution of the species in the county.

Although the slow worm's distribution is as yet incompletely known in parts of the county, some interesting features are beginning to emerge. Its absence from the well recorded broadland 10 km squares of TG41 and TG42 reflects the species' avoidance of low lying areas subject to flooding. This assertion is in agreement with Ellis (1965) who wrote "...hardly ever met within marshes subject to flooding, but inhabiting some of the adjacent ground, usually where this is sandy and supports a vegetation largely of grasses, gorse and bracken." With the exception of a single record from a garden in Wells the slow worm, like the adder and grass snake, is apparently unknown in NW Norfolk. The main area for records is the tract of countryside from central Norfolk to NE Norfolk where suitable habitat exists (Fig.5). It is also found in sites associated with the Holt/Cromer ridge, in SE Norfolk and sites along the county boundary with Suffolk. Further records come from Breckland and west Norfolk heathlands. No records have been received from the fens and more field work is needed to confirm the absence of the species in that part of the county.

The habit of basking in sunshine makes the common lizard the easier of the two species to find. Systematic attempts should be made to try to fill some of the gaps in the distribution map and at least determine whether it can be found in each of the county's 10 km squares. Although more difficult to locate by direct observation in suitable habitat the slow worm can be found by searching under objects lying on the ground. Some naturalists/scientists have solved the problem of trying to locate this species by putting out pieces of scrap metal for slow worms to hide under. This type of study needs to be conducted discreetly and the metal removed at the end of it. Another approach may be to search for this species on warm summer evenings when they have been found in the open.

Changes in status and conservations

There can be little doubt that both species have declined in abundance since the middle of the last century when Southwell (1871) commented upon their status. He recorded the common lizard as frequent on heaths, hedge banks, and dry places and whilst the same is broadly true today such habitats are now much rarer. The loss of heathland sites to afforestation, agriculture and other uses will have had as deleterious an effect upon the slow worm and common lizard as upon the adder and grass snake (Buckley, 1987). In addition to the loss of heathland there has been the much publicised loss of hedgerows in recent decades. The loss of hedges and their associated banks will have caused the extermination of lizard colonies without a trace. The loss of suitable habitat can be due to more subtle changes than ploughing

or afforestation. Ellis (1965) noted the disappearance of the common lizard from many of the mowing marshes of broadland after the cessation of mowing. In a similar way the loss of the rabbit due to myxomatosis after 1953 must have had a powerful influence upon the availability of lizard habitat. Grazing by rabbits kept the vegetation short, hindered plant succession and thus provided plenty of sunny patches for the common lizard. Pollard, Hooper, and Moore (1974) mention that the common lizard appeared to be much less common along the woodland edges and hedgebanks of the Wealden sands district after 1953 than formerly.

Southwell (1871) considered the slow worm to be not uncommon on heaths and in dry woods. Miller and Skertchly (1878) described it as apparently less common in Cambridgeshire than in most parts of the country and Gadow (1904) considered it to be very local and rare. Lubbock (1879) records the observations of Rev. H. T. Frere of Burston where slow worms were considered very common, and of Mr Gambling of Norwich who recorded the birth of slow worms in September 1877. Lubbock, like Southwell, considered the slow worm to be not uncommon. Presst et al. (1974) noted that although neither species had been the subject of a special study, they were unlikely to be endangered on a national scale. More recently Cooke and Scorgie (1983) conducted a survey of the status of the commoner amphibians and reptiles in Britain. They used a questionnaire and asked recorders to give the status of the various species in 1980, the change of status since 1970 if any, and the reason for any change in status. The responses were then processed to give indices of abundance (range 0-1) and changes of status (range -1-+1) on a regional basis. In East Anglia the common lizard was considered to be widespread and fairly common (index 0.73), the slow worm fairly widespread but not common (index 0.63). The responses of the 10 East Anglian recorders indicated that both lizards had decreased in abundance, the common lizard (index of change -0.48) more so than the slow worm (index of change -0.34). The results suggest that the common lizard, the most common reptile, had declined the most. Ninety three percent of the reasons given for the decrease in the common lizard were the loss of suitable habitat. The slow worm had the lowest status index of the 4 reptiles in the region, but the second lowest index of change. Seventy percent of the reasons given for the decrease related to habitat loss, the others being predation, road casualties, collection and agricultural chemicals.

Since 1981 the four common reptiles have been protected under section 9(5) of the Wildlife and Countryside Act. This simply means that they cannot be sold without a licence. Unfortunately at least one Norwich pet shop has such a licence and sells native species. This is to be regretted because a trade in native species encourages collectors to take more specimens from the wild than they might otherwise do and over-collection can lead to local extinctions. The common species would certainly benefit from legal protection such as that given to the rarer species—the smooth snake, sand lizard, natterjack toad and great crested newt. In 1986 the Fauna and Flora Preservation Society proposed legal protection for all the commoner species of reptile and amphibian (Langton, 1986). This year, because of a lack of agreement between conservation bodies, it was decided to press the government to give greater legal protection just to the reptiles and not the amphibians. In December Nicholas Ridley rejected the advice of the Nature Conservancy Council and excluded the adder from the new legislation which makes it an offence to kill or injure the grass snake, slow worm and common lizard. Whilst this may be seen as progress there is an obvious loophole in the law. Any person killing a slow worm, grass snake

or smooth snake can simply claim that they thought it was an adder. The common lizard has never been under threat, simply from people killing it, but the slow worm is quite often killed by people thinking it might be a poisonous snake. Only when all snakes are protected wil the slow worm benefit from the recent legislation. By failing to give the adder any legal protection the government has failed entirely to implement a Council of Europe Committee of Ministers' resolution made ten years ago, (Keith Corbett pers. comm). Lizards are in a situation which is unlikely to improve except where favourable management is undertaken. Not only have their habitats been lost to urban developments, agriculture, gravel extraction and afforestation, but also by plant succession to woodland. Lizards have very poor powers of dispersal and habitats created by taking land out of agriculture or making road cuttings etc are likely to remain uncolonised by these species.

Many former heaths exist only as names on an ordnance survey map e.g. Massingham Heath and Roughton Heath. Others have been reduced to a mere fragment of their former extent, e.g. Syderstone Common and Mousehold Heath. Unfortunately it is not enough to protect heathland against physical loss: it also requires management. Rackham (1986) documents the decline of Mousehold Heath from its former 6,000 acres to its present 180 acres. He also suggested that soon it would completely disappear. This formerly wild and glorious place, once an inspiration to George Barrow and the Norwich School of artists is degenerating into an indifferent kind of woodland. Its owners, Norwich Corporation, have yet to show the resolve necessary to halt this sad decline. On Mousehold much scrub needs to be removed from heathery areas and trees felled to allow the ground cover to regenerate. Whilst it is to be regretted that some land owners have neglected their heathland it is even more unacceptable for public bodies and conservation organisations to do the same. The county needs a heathland policy to identify and help conserve the heathland fragments which still remain.

Heathland, because of its small number of plant species, has been the neglected habitat of nature conservation. Ancient woodland, chalk grassland, bogs and fens have attracted more attention. In the absence of grazing or management many heaths have been maintained largely by fire and the myth has grown up that this is the tool to be used. Fire kills reptiles unless they are underground and should they survive the fire they then have no habitat in which to feed and elude predators. After a fire it is some time before the habitat becomes suitable for lizards again. A study made by Simms (1969) in Yorkshire shows that it takes at least 3 years for a burned area of heath to acquire a population of common lizards comparable to the pre-fire level. Webb (1986) suggests that fire was not used as a management tool on lowland heaths until they began to fall into disuse at the beginning of the 19th century. It would have been wasteful to have burned the useful materials which heathland provided.

Fire is an ever present threat to heathland and sites need to be fire-breaked prior to scrub clearance. When the vegetation is free of tall gorse and other scrub a relatively narrow strip of bare soil can prevent the spread of fire across the heath. These breaks by their very nature provide sandy areas which have been a missing component of many heaths since the demise of the rabbit and the cessation of turf cutting.

Although heathland is still under threat by the pressures outlined above there are some grounds for optimism. Even the most promising piece of heath is worth keeping as it can be restored by appropriate management. Owners of such habitats should be encouraged to manage them in a sympathetic way and when necessary

receive financial help for doing so. In the next year or so it should be possible to identify and establish sites within Forestry Commission holdings in Norfolk for reptile conservation and this will be of direct benefit to the species. Naturalists can continue to help in many ways; by recording their observations, supporting the actions of County Trust and Nature Conservancy Council, undertaking their own conservation projects, and putting the case for conservation of particular sites to land owners and planners.

Acknowledgements

I am particularly grateful to those who have collected together records from other observers and forwarded them to me: notably J. G. Goldsmith (Norwich Castle Musem), R. E. Jones (Lynn Museum), N. Gibbons (Thetford Natural History Society) and M. Jones (Suffolk Naturalists Society). I am also most grateful to the following observers for sending in details of their sightings. Without their help this paper would not have been possible. Thanks are also due to Caroline Le Maistre for helping to type the manuscript.

J. Antram
C. N. Arnold
F. H. Ashton
R. Bailey
R. E. Baker
R. A. Baltrock
P. Banham
J. Barnard
R. Barnes
J. Baxter
L. Bensley
D. Billings
B. C. Bird
M. Blackburn
W. J. G. Boarder
E. F. Boosey
W. J. A. Boyd
M. A. Brewster
R. S. Broke
A. L. Bull
D. A. Buttle
BRC Monks Wood
K. Carmichael
P. R. Clarke
G. Clarke
D. E. Clodd
P. R. Cobb
R. Cobbold
M. Comer
G. Coupland
E. Cross
E. T. Daniels
M. Danvers
C. L. Davies
L. Dearsley
R. J. Driscoll
K. C. Durrant
J. Edwards
E. A. Ellis
R. Evans
F. Farrow
R. Foster
O. B. Fowler
J. E. Gaffney
K. M. Gilbert
H. B. Ginn
J. G. Goldsmith
S. Goldsmith
P. J. Gotham
B. Gregory
R. Gribble
R. Hadman
C. Haines
M. R. Hall
H. Harridence
R. N. Harvey
G. Hayes
P. J. Heath
T. Holzer
R. J. Hornby
A. G. Irwin
J. Ismay
C. Jenkins
J. L. Jones
M. L. Jones
R. E. Jones
P. Keeler
G. I. Kelly
H. Herrison
I. Keymer
P. Keymer
S. G. Lake
P. W. Lambley
B. H. Lawfield
R. Leaney
A. R. Leech
D. Leech
S. Linsell
J. Lunn
R. Malt
D. J. Manns
R. P. Martins
D. M. Maxey
J. Mayhew
W. F. Milligan
T. A. Moore
C. Neale
J. Newton
C. G. Packham
S. Paston
C. P. Petch
F. Pigg
P. Pratley
J. L. Raincock
J. Reed
D. I. Richmond
R. M. Richmond
T. D. Robinson
E. V. Rogers
E. Rose
D. Sampson
D. E. Sargeant
K. C. Saul
H. Scott
N. Sills
R. Southwood
D. Stapleford
R. Starling
P. G. F. Steele
R. Stevenson
R. W. Thomas
J. Tooley
J. Webster
G. E. White
A. C. Wilson
J. Winterton
M. Woolner

References

AVERY, R. A. 1975 Clutch size and reproductive effort in the lizard *Lacerta vivipara* Jacquin, *Oecologia* (Berlin) **19**, 165-170.

BUCKLEY, J. 1975 Amphibia and reptile records from Norfolk. *Trans. Norfolk Norwich Nat. Soc.* **23**(3), 172-192.

BUCKLEY, J. 1987 The distribution and status of snakes in Norfolk. *Trans. Norfolk Norwich Nat. Soc.* **27**(5), 353-361.

COOKE, E. S. & SCORGIE, H. R. A. 1983 *The status of the commoner amphibians and reptiles in Britain.* Peterborough: Nature Conservancy Council (Focus on Nature Conservation Series No. 3).

ELLIS, E. A. 1965 *The Broads.* London: Collins.

FRAZER, J. F. D. 1983 *Reptiles and Amphibians in Britain.* London: Collins.

GADOW, H. 1904 Reptilia and Amphibia of Cambridgeshire in Marr, J. E. & Shipley, A. E. *Handbook to the Natural History of Cambridgeshire,* 100-107.

LANGTON, T. E. S. 1986 *Protecting Wild Reptiles and Amphibians in Britain.* London: Fauna and Flora Preservation Society.

LUBBOCK, R. 1879 *Observations on the Fauna of Norfolk and Norwich*, 209-211.
MILLER, S. H. & SKERTCHLY, S. B. *The Fenland Past and Present*. London: Longmans, Green & Co.
POLLARD, E., HOOPER, M. D. & MOORE, N. W. 1974 *Hedges*. London: Collins.
PRESTT, I., COOKE, A. S. & CORBETT, K. 1974 British amphibians and reptiles in Hawksworth, D. L. (Ed.) *The Changing Flora and Fauna of Britain*, 229-254. London: Academic Press.
RACKHAM, O. 1986 *The History of the Countryside*. London: Dent & Sons Ltd.
SIMMS, C. 1969 Recolonisation of burnt heath by lizards *Lacerta vivipara* (Jacquin) *Brit. J. Herpetol.* **4**, 117-120.
SIMMS, C. 1970 *Lives of British Lizards*. Norwich: Goose & Son.
SMITH, M. A. 1951 *British Amphibians and Reptiles*. London: Collins.
SMITH, N. A. 1985 The ecology of the slow worm *Anguis fragilis* L. in southern England. *British Ecological Society Bull.* **16**, 18-20.
SOUTHWELL, T. 1871 Mammalia & Reptilia of Norfolk. *Zoologist* (2nd series) 2751-2760.
STREET, D. 1979 *The Reptiles of northern and central Europe*. London: Batsford.
WEBB, N. 1986 *Heathlands*. London: Collins.

RECENT RECORDS OF INVERTEBRATES

R. E. Jones

The Lynn Museum, Old Market St., King's Lynn.

These notes supplement the reports on woodlice, false-scorpions, centipedes and millipedes published in these Transactions (Irwin & Jones, 1984; Jones, 1985, 1986, 1987), and also give an account of the terrestrial flatworms of Norfolk. Records are by the author unless otherwise stated. Full details have been deposited in the Norfolk Biological Records Centre and with BRC, Monks Wood.

Woodlice

Armadillidium nasatum Budde-Lund and *Porcellio laevis* Latreille have both been collected from a rubbish tip at Appleton in W. Norfolk on several occasions and appear to be well established colonies. *P. laevis* has also been collected by J. G. Goldsmith from a rubbish tip at Methwold Hythe. The first record of *Porcellio dilatatus* Brandt from E. Norfolk since the 1940's was of one collected from Flordon Common in May 1986. *Trichoniscoides albidus* (Budde-Lund) is still under-recorded but specimens have been collected from a ditch in the Gaywood Plantation at King's Lynn, a river bank at Welney and a wood at Woodton.

One new species has been added to the county list and that is *Trachelipus rathkei* (Brandt). The author first collected this species at Welney in September 1984. The site is within the modern administrative county of Norfolk but outside of the W. Norfolk vice-county by about 20 feet, (the width of the road that forms the boundary!). Attempts to find it on the other side of the road were not successful. The first official Norfolk record from vice-county 28 is thus from Hockwold cum Wilton where A. G. Irwin collected it on 7 May 1985. The animal has colonised the man-made river banks which cross the fens and which appear to provide a similar habitat to that of the damp, rough grassland on clay soils in which it occurs in the Northamptonshire and Huntingdonshire vice-counties.

Centipedes

A new addition to the county list is *Geophilus fucorum serauti* Brolemann, a single specimen of which was sieved from muddy shingle on the landward side of Blakeney

Point by A. G. Irwin, M. Collier and the author in October 1987. This is a littoral species which hitherto had only been collected from the west coast of Britain. Numerous *Strigamia maritima* (Leach) were also found at the same site.

Lithobius curtipes C. L. Koch has been collected from a wood in Woodton in E. Norfolk, a new vice-county record.

There have been several reports of luminous centipedes from the county but no specimens have reached the author to enable a positive identification of species to be made.

Millipedes

A surprise was a single female *Leptoiulus belgicus* (Latzel) collected from a rubbish tip at Appleton in 1987 and new to the county list. This cylindrical species is dark brown with a single, pale yellow dorsal line and normally is only to be found in Devon, Cornwall and South Wales. How this specimen came to be in Norfolk is unknown but another single record from Dover (A. J. Rundle *pers. comm.*), well outside its accepted range shows that it may turn up anywhere.

The discovery of *Stygioglomeris crinita* Brolemann in a damp ditch under elders at Hockering in October 1987 by A. G. Irwin provided the first vice-county record for E. Norfolk of this tiny pill-millipede.

The colony of *Unciger foetidus* (G. L. Koch) at Dersingham continues to thrive but no records have been made from elsewhere in the county.

False-scorpions

Roncus lubricus L. Koch was collected from a garden on the Ipswich Road, Norwich. It is the first record for vice-county 27.

Flatworms

Only two terrestrial flatworms have been recorded from the county. One species *Microplana terrestris* (Muller) is common. It is greyish in colour, paler beneath and may be a contracted, shapeless, slimy blob when resting or a long, tapering, ribbon shape when active. *M. terrestris* can be found in a variety of habitats such as woods, ditches and gardens, usually under stones, wood or rubbish where the soil is damp. It is an extremely delicate creature and consequently difficult to collect but the best results are obtained by dropping it directly into 70% alcohol. There are numerous records from E. and W. Norfolk.

In 1985 a tiny flatworm, about 2mm in length was collected from under moss covered pantiles on damp soil in a garden in Smallborough. It was identified by H. Jones of Manchester University as *Microplana humicola* Vejdovsky and is the first confirmed specimen of this species recorded from Britain. It has also been collected from Devon by H. Jones and this author has found it in Northumberland so it would appear to be widespread but not surprisingly it is overlooked.

The author would like to thank everyone who has sent him specimens for identification and urges them to continue to do so.

References

IRWIN, A. G. & JONES, R. E. 1984 The woodlice of Norfolk. *Trans. Norfolk Norwich Nat. Soc.* **26**(5), 272-281.

JONES, R. E. 1985 The false-scorpions of Norfolk. *Ibid* **27**(1), 67-71.

JONES, R. E. 1986 The centipedes of Norfolk. *Ibid* **27**(3), 221-226.

JONES, R. E. 1987 The millipedes of Norfolk. *Ibid* **27**(5), 363-369.

BIRDS ON THE FARM—A TWENTY-FIVE YEAR STUDY

A. L. Bull

'Hillcrest', East Tuddenham, Dereham, Norfolk.

Abstract

The aims and origins of the Common Bird Census are discussed as are the methods used to obtain uniform and adequate coverage of the census plot. The area in which the census is carried out is described, as are the effects of hedgerow and field pit removal on bird populations, both short and long term. Also considered are the effects of severe winters, and of recent changes in farming practice, both on bird populations, and on other forms of wildlife.

Introduction

The British Trust for Ornithology introduced the Common Bird Census in 1962 on the instigation of the Nature Conservancy (now the Nature Conservancy Council) following a pilot study in 1961. The primary objective was to monitor the effect of toxic chemicals on bird populations on farm land. The effect of hedgerow removal was also considered to be of importance. C.B.C. plots in woodland were encouraged, especially from 1964 onwards.

The author started work on a C.B.C. plot at Church Farm/Booters Hall, Cranworth about 7 miles south-west of East Dereham in 1962. The chosen plot has been censused annually since that date, 1986 being the 25th season. The plot lies on the north bank of the Blackwater River, which forms the southern boundary for 1,600 metres. It consists of 246 acres (99.4 hectares) of an 800 acre farm. At the time the plot was selected, it was considered representative of the mixed farming economy then practised on the farm as a whole.

At that time, there was a set of farm buildings roughly at each end of the plot, with a dairy unit near the Blackwater River, close to the buildings at the north-western end.

Cranworth village forms the northern boundary, with the exception of two pairs of cottages and the church which, being to the south of the road, were included in the plot. However, a council housing estate to the south of the same road is omitted for obvious reasons.

A tenant farmer occupied the farm from approximately 1940 until 1968, when he died. During his tenancy, the hedges had remained largely undisturbed until 1966, when the landlords gave him twelve months to cut them all and clean out the ditches. This first cut of his tenancy was carried out right through the following year, including the breeding season.

On his death, the landlords took the farm in hand and put a manager in to run it. Within three years, they had embarked on a policy of hedgerow removal, the short term effects of which have already been discussed elsewhere. (Bull, *et al*, 1976). That study compared data from the period 1965-68 with that from 1971-74. Subsequent results suggest that four years is too short a period to form an accurate assessment.

Description of plot

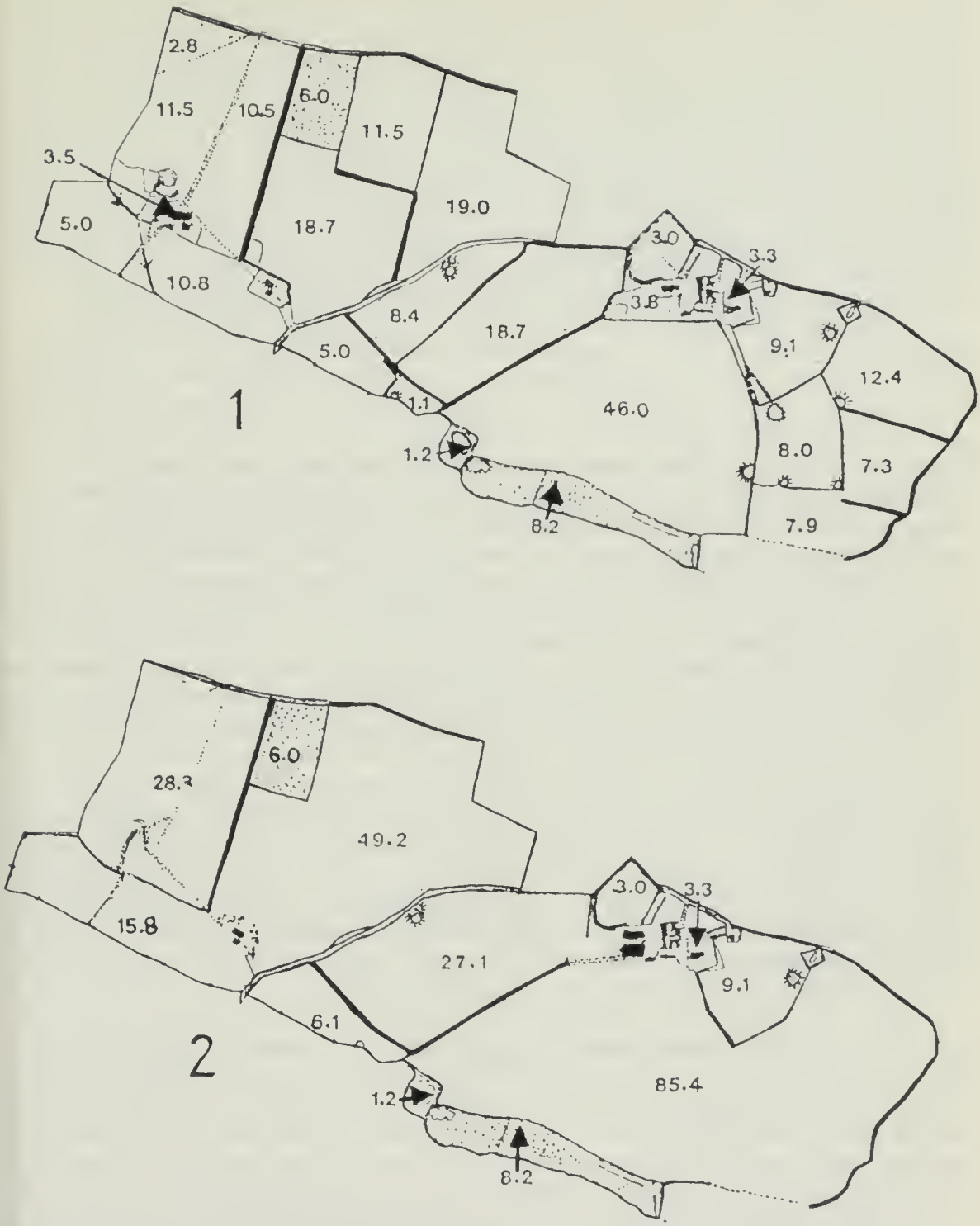
The plot in 1962 and the plot today bear little resemblance to one another (Figs. 1 and 2). At the south eastern end in 1962 were four fields between seven and twelve

acres in extent, containing five water-filled field pits. Two of these were small, and overshadowed by vast thickets of blackthorn. A third was more open, with a little weed, a fourth was rich in aquatic plants and insects and usually held a pair of sedge warblers in season. The fifth was a real gem, being about a quarter acre in extent, with a few bushes for cover, and with abundant aquatic flora and fauna, including common frogs, common toads, and both smooth and great crested newts. Adjacent to these to the west, was a field of some forty acres, and to the north, eight acres known as Church Meadow. This was Glebe land, and was rented from the Rector by the tenant farmer. In the holocaust, all the fields became an awkward shaped 85 acre monstrosity. The Church Meadow was let by the rector to another farmer a mile or so away, as he had a difference of opinion with the Estates' manager almost as soon as he moved in! Later, when the Church commissioners cashed in some of their assets, the tenant bought it. Thus, Church Meadow is one of only two areas which have not felt the wind of change. The other is a narrow strip of marsh between the former forty acre field and the Blackwater River. This has always belonged to an adjacent farmer, but was included in the plot to make the river a viable boundary. The only change there, was the grubbing up of a single clump of rampant blackthorn on a drier area of the marsh. Several others still occur in the wetter areas. There has also been a slight drying out of the marsh itself, possibly as a direct result of the hedge removal and ditch filling next door, to facilitate which, the Internal Drainage Board allowed the owners to deepen the bed of the river by up to two feet for half a mile below their property.

Downstream of the marsh, and acting as a buffer between arable and river, is Potters Carr. This is a seven acre S.S.S.I. alder carr which has changed little in the lifetime of the local residents. This is an important reservoir of birdlife, which frequently spills out into the surrounding countryside, and provides registrations of both spotted woodpeckers, willow tits and many more. Though hedgerows are entirely peripheral at the south eastern end of the plot, they do contain quite a number of old trees, as does the Church Meadow hedge. Church Meadow itself, with two small pits is the only readily available source of water at this end of the plot. The big pond, known picturesquely as "Nights' Pasture Pond", put up a terrific battle for survival, the springs that served it defying one drainage scheme after another. It finally succumbed to an assault of farm refuse, spray cans etc, topped by layers of dirt from the sugar beet elevator in 1986, roughly 15 years after the first attack!

In a situation such as the one pertaining at Cranworth, present day bird populations are much affected by the nature of the surrounding countryside. Just as Potters Carr and a series of small marshy meadows downstream from the Carr, are a reservoir for the peripheral hedges at the south eastern end of the plot, so is the grounds of the former rectory, with it's attached woodland, of importance to the Church Meadow/Churchyard and Church Farm.

Lamentably, the churchyard itself has altered dramatically over the past five years. In other words, it has gone from one extreme to another. Until that time, both church and churchyard had become sadly neglected, with holes in the roof of the south aisle, and nettles and brambles threatening to swamp everything. The bird life was excellent. Today, though the trees still surround the square plot, these are not old enough to have nest holes in them, and the only places left for birds to nest, apart from one straggly upright juniper, is in the church itself. The church tower, which for a number of years held a pair of kestrels, now provides home for up to 20 pairs of feral doves who arrived a few years ago from no-one knows where.



Figs. 1 & 2 The Cranworth Common Bird Census plot.
1 — In 1962. 2 — At the end of the 1986 season.

Reference to the map will reveal that three farm roads divide the plot. Currently, the one at the north western end, and coming down past the old dairy unit, carries the most traffic, as this is concreted to and beyond the river crossing. The middle lane, which arrives at the same river crossing, was formerly the most used, but for most of it's length it has become an almost forgotten grassy lane. Beside it are two important features. The first is a narrow spinney about seventy yards long which has not been interfered with at all, and the other is a series of three bush grown and partly drained pits known collectively as "The Clay Pits". These used to provide water for the cows on a former semi-permanent pasture of eight acres. This meadow, with good hedges and many old trees was at one time, the most important bird habitat in the central part of the plot. It held nest sites for both tawny and little owl, in the early years of the survey. In the central section, both north east and south west of the plot, the countryside is very much 'more of the same'.

At the north western end, Booters Hall, its screening hedges, and its range of old farm buildings, were of prime importance. Especially so, was the former orchard, of about an acre. This had thickets of blackthorn and bramble, ancient fruit trees with abundant nest holes, and the silted up remnant of a former moat which provided secret drinking places deep under the brambles. The wood marked on the map to the north east of the house, was mainly of Douglas fir and Scots pine, with some larch, and three blocks of beech, one of ash, and with a few oaks and yews in one corner. In the middle was a small clearing completely surrounded by towering mature Lawson's cypress, much beloved by goldcrests. This had been planted about 1900, and had been completely unmanaged, as a consequence of which, it was extremely dense. This area held well over 50 pairs of woodland birds annually until 1976. In January of that year, readers may remember a gale which devastated thousands of acres of woodland, the owners decided to clear, fell and replant the area. The three blocks of beech were only thinned, and the oak and yew corner was left. The replanting went ahead in due course, nicely mixed, with pine, oak and beech, and possibly others, but within two years, the lower half was six feet high with broom, the seeds of which must have been laying dormant since the 19th century. The remedy for the broom was a tractor mounted Bomford Bushwhacker, which would have done a good job had the driver been alerted as to the whereabouts of the young trees. In 1986, several bushwhackings later, it is doubtful if half the planting has even survived, whilst at least half those which have, look like leftovers from some dreadful battle, deformed, and with limbs missing. Of the seven or eight pairs of birds using the area in 1986, three were common whitethroats, or about 60% of the total for that species for the whole plot.

To return to the Booters Hall house and buildings, these were destroyed at the time of the main hedgerow removal, whilst the orchard remained until 1976 or 77. The final clearance meant that all bird life had become purely peripheral, apart from one hedge running west from the plantation, and a total of three hedges beside the two more easterly farm roads. It should be pointed out that current hedgerow management is rigorous in the extreme, all hedges getting a very short back and sides annually, leaving them about two to three feet high and barely a foot wide.

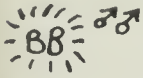
Over the boundary of the plot at the north western end are three areas of woodland, two of which belong to a neighbouring landowner. These alone help to keep the Cranworth C.B.C. in some sort of heart. Should these at any time be felled, given the present management on the plot, it is safe to predict that there would be little or no bird life left in the area.

Common bird census: Methods

At the outset, an optimum number of eight visits per year were recommended for each plot. With experience, this was proved to be insufficient, and from 1978, the figure has been ten visits per year. These are best carried out in the early mornings or late evenings, when territorial behaviour is at its strongest. The present study has been carried out almost exclusively in the early mornings, as human disturbance is at a minimum at that time. The ten visits are made between roughly March 21st and June 21st, with an occasional supplementary visit to cover specific problems, as late as early July. All hedges are followed, and especially the boundary hedges, and very large fields may be walked across if this is thought necessary, insofar as cropping allows. The present practice of leaving 'tramlines' for spraying tractors to follow, is of assistance in that respect, until crops get above knee-level.

All birds are plotted on visit maps, using different symbols for different forms of activity eg:

Ⓑ —Male blackbird singing. B —blackbird scolding.



—two male blackbirds fighting.

Certain species are omitted as a general rule. House martins are only included if they have visible nests on the plot, and similarly, rooks, whilst, from the beginning, wood pigeons and house sparrows were omitted, and still are from the Cranworth plot, for the sake of uniformity. Certain species are plotted 'in hope', such as meadow pipit, which is present in most springs until late April, but has never stayed to nest, even when there was 85 acres of rough grass for it to choose from!.

Each visit lasts from 3 to 5 hours, depending on the level of activity. At the end of each season, all the registrations on the visit maps are transferred to species maps, the study of which will reveal the territorial limits of each pair of a species, even with such birds as skylarks in an 85 acre field.

The effect of severe weather on bird populations

Severe weather can come in various guises: unabating severe frosts, with or without snow: large amounts of snow, more usually without very severe frosts. The most damaging is undoubtedly severe frost with little or no snow cover, followed by heavy snowfall on frozen ground, the whole lasting for many weeks, as happened in 1963. Even in such extreme conditions, populations can recover with remarkable rapidity given more favourable conditions in subsequent winters, and a reasonable environment. One species more than any other, reflects this—the wren.

Table 1 Number of wren territories in each year, 1962-86.

62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
20	1	6	15	21	22	29	18	20	20	21	31	39	30	39	20	24	3	8	17	6	13	13	13	7

From the above, the really bad winters are instantly obvious, with 1962/63 and 78/79 being particularly harsh, with much snow and frost. 1979 was notable for severe blizzard conditions, though of shorter duration than 1963. Note the continuing increase in the population during the mild winters of the early 70's despite the hedgerow removal of that period. Thus one can conclude that providing the winters are mild hedgerow removal may have very little effect on the wren population. It will be noted that while the hedgerow system remained intact, the population recovery

from such a winter as 1963 is complete within three seasons. On the other hand, severe winters after the removal of the hedgerows has resulted in a slower recovery rate, to a much lower population level than prevailed before.

Short and long term effects of hedgerow removal on bird populations

To project the above a bit further, figures for a number of common species will be considered, in a number of arbitrarily chosen years. These are 1966, which was the National Datum year, against which all subsequent changes in populations are judged, 1973, following hedgerow removal, and also a year in which the national index for Blackbird was roughly identical with 1966, 1979, following the blizzard winter, and 1984 and 85, to give two recent years totals. This was felt desirable in case any particular factor resulted in a freak return for any particular species.

Table 2 Returns for a selection of 'woodland' and 'field' species in given years.

	1966	1973	1979	1984	1985
Mallard	3	10	8	12	11
Red-legged partridge	5	11	17	10	8
Moorhen	14	10	9	8	9
Skylark	12	25	28	24	27
Blackbird	51	30	26	32	29
Song thrush	18	13	9	12	7
Robin	30	31	12	11	9
Dunnock	52	46	27	21	16
Chaffinch	33	26	21	30	32
Yellowhammer	20	22	22	17	20

The figures from the years 1966 and 73, are roughly comparable with the average for the four years on either side of hedgerow removal in the previous study. That study gave a difference % for each species, actual *versus* predicted. Thus mallard at 71 in that study was up 71% more than the national indices indicated. The other comparable figures were as follows: moorhen -18%, red-legged partridge +93%, skylark +80%, blackbird -25%, song thrush -19%, robin -11%, dunnock -20%, chaffinch -3% and yellowhammer +3%.

The field species, mallard, red-legged partridge, moorhen, skylark, and to a lesser extent, yellowhammer, all appear to have benefitted from the hedgerow removal, with the exception of moorhen. This is to be expected, with the infilling of 5 field pits which formerly held nesting moorhens. Of the others, red-legged partridge has fallen back considerably since a peak in 1979.

Skylark figures seem to have remained fairly constant at around 100-130% compared with 1966. In this case, 1979 failed to give a true picture, as, in the three preceeding years the number of territories had been between 35 and 39, while in 1980 the species actually peaked at 47 territories. This latter 'freak' year was entirely due to cropping, in which the 85 acre prairie had a very thin crop of ryegrass for seed, with the result that it was packed with skylarks! Nevertheless, there has been a gradual decline toward the end of the period under review, as the last two seasons indicate, and the 1986 figure was at about the 1984 level.

Yellowhammer seems to have remained remarkably constant, no matter what has happened to the habitat. The same might be said of chaffinch, the only other seed eater in this table. It did dip, but it has recovered again quite well. This is

probably due more to the fact that, of the hedges removed, the only one containing a quantity of trees likely to be used as song perches, was the one down the east side of the Clay Pit Meadow. Trees for song perches seem more important to the chaffinches than hedges in which to nest, especially, in many cases, as the trees have ivy on them which can fulfil the function of the hedge.

The four remaining species in Table 2—blackbird, song thrush, robin and dunnock—show different long term reaction to the hedgerow removal. In the first few years, the numbers of the two latter species declined less quickly than the former two. More recently, the decline of robin and dunnock have continued while that of blackbird has remained remarkably constant since the initial drop. Song thrush numbers have been erratic, with a tendency for there to be wild fluctuations between one year and the next, though the average numbers are about the same as they were immediately after the earlier study.

It would appear that the two smaller species are much more sedentary than the two larger, thus, following hedgerow removal, they stayed in their traditional haunts and made the best of a bad job—or in the nearest site to their former territories. Because the remaining hedges are trimmed annually in such a manner as to give absolutely no cover to any bird until after the leaves are open, the recent series of late springs have gradually eliminated these very marginal territories. With no cover in such hedges at least until May, the blackbird and song thrush population nest in the nearest available cover, and fly quite long distances to collect food, for instance, to one or other of the big heaps of slurry deposited at strategic points round the farm. Robin and dunnock on the other hand, not only have to nest where there is sufficient cover, but also, where there is ample food supply near at hand. For this reason, some sites which appear suitable no longer have one or other of the smaller species.

The effect of recent changes in agricultural practice

Factors other than hedgerow removal, and the original rash of toxic chemicals, have in recent years, played their part in modifying bird populations. The development of a whole arsenal of herbicides, fungicides and insecticides means that the farming community now has a spray for every hazard, real or imagined, which can assault their crops. This arsenal lies behind the habit which has developed in recent years, of leaving 'tramlines' in cereal crops, thus enabling spraying tractors to operate with minimal damage to the crop, almost until harvest, by which time the target is likely to be various rusts and smuts which attack the developing and ripening grain. Earlier in the season, a wide range of herbicides are spread over the fields in a fine mist. Herbicides have become so selective that it is now possible to spray such fleshy broad leaved crops as sugar beet, and, without damaging the beet, destroying all the creeping underground stolons of couch grass. It is in this field that we find the cause for the rapid diminuation of certain species of birds over the past five years.

When the fields are combined, due to the efficiency of the herbicides used earlier in the season, there are no seeding weeds in the stubbles. In the majority of cases, the stubbles are no longer left until at least after harvest before being broken up. Today, most are cultivated or ploughed within two or three days. Thus, there is no belated harvest of weed seeds for the family parties of seed-eating birds, many of whom gear their nesting to coincide with this period of the year (July to September). This has resulted in the reduction in numbers of several species in this category, one or two to the verge of extinction, at least locally. Using the same years

as in Table 2, we will look at the status over 25 years of three species of seed eater-linnet, reed bunting and tree sparrow.

Table 3 Returns for three species of seed-eating birds in given years, showing population decline.

	1966	1973	1979	1984	1985
Linnet	6	7	8	5	3
Reed bunting	3	4	2	2	✓
Tree sparrow	21	15	20	4	3

Reed bunting fared a little better in 1986, with a single territory, but tree sparrow continued to decline, with only a single territory recorded. The decline started in 1981, but there were still 10 tree sparrow territories in 1983, which indicates something in the nature of a catastrophe for this class of seed-eating bird in our countryside.

Changes in status of summer migrants

These have not been dealt with as thoroughly as the resident species, as their wanderings over vast distances raises too many imponderables for a study of this nature. This is especially true of such species as common whitethroat and sedge warbler—sufferers in their wintering quarters, south of the Sahel. Nevertheless, with a much more hostile environment when they arrive here, their numbers must be at a minimum, as both need bushy places in which to set up territory.

The common whitethroat would be almost non existent today, were it not for the bramble grown plantation, which has supported three pairs for two summers past. Sedge warbler, meanwhile, has disappeared, even though the marsh has not changed, and formerly held three pairs.

Table 4. Returns for three species of summer migrant in given years, showing population decline.

	1966	1973	1979	1984	1985
Common whitethroat	16	2	3	3	6
Sedge warbler	7	1	-	-	-
Swallow	5	3	3	3	3

No doubt the destruction of the field pits contributed to the elimination of the sedge warbler. It can be seen that the destruction of the Booters Hall complex had the effect of a permanent 40% reduction in the swallow population.

The effect of all changes on other forms of wildlife

Improved herbicides have virtually wiped out the populations of plants formerly associated with arable land, such as the long prickly headed poppy, *Papaver argemone* and the night flowering catchfly *Silene noctiflora*, both of which were not infrequent at the beginning of the study. A more sinister practice has crept in over the past six or seven years, of spraying a metre wide band of the 'brue' (the field bank) with a mixture of Simezine and Paraquat. This cocktail makes a total weed killer from which only the most deeply rooted plants can recover, and has the effect of keeping an area between hedge or ditch and crop, completely free of vegetation, and especially of weeds which can seed and encroach into the field in subsequent years. This is

reputed to be beneficial to partridge chicks, to enable them to dry out quickly in the event of a cold damp spell at hatching time. Conversely, it undoubtedly also destroys some of their potential nesting habitat! This annual assault on the field margins means that almost the only plants surviving round the fields are coarse grasses, and there has been a marked decline in such species as cowslips, primroses, violets and greater stitchwort, whilst the lovely wild columbine, formerly frequent in the area along field margins, disappeared nearly 20 years ago.

The depletion of the flora has meant a corresponding depletion of the fauna, and especially the invertebrate fauna. Butterflies are now few and far between, and dragonflies and damselflies almost non-existent, though the disappearance of the two latter is due more to the field pit destruction, than to the more recent sprays.

Surprisingly, the mammals, seem to be surviving quite well, with a still viable population of hares, though fewer than 25 years ago, when it was common place to see seven or eight playing 'follow my leader' in March. Fox, stoat, weasel and rabbit can still be found on the plot, but the enchanting red squirrel no longer prances along the top of the church wall with stolen filberts. However, his odious cousin the grey squirrel, nips out of the woods and snips through wheat stalks to carry the heads into the wood to devour. There have even been some mammalian gains. A few years ago, a small group of red deer were present in the area for a year or two. These were not welcomed as they would go through the electric fences and let the cows out. Roe deer, on the other hand, now seem to be a permanent part of the fauna. During one visit in 1986, I was fascinated to watch a fawn gambolling beside its mother at scarcely 50 metres, when I came in sight of a clearing beside a field of oil seed rape.

Conclusions

There can be no doubt that there have been profound changes in the bird life, and in the flora and fauna of the census plot at Cranworth during the period of the study. Although hedgerow removal can be indicated as being the prime reason for the changes, many other factors have to be taken into account. Bird populations are changing all the time, and, in the case of the tree sparrow, sometimes these changes are in areas that are least expected.

The future

This looks gloomy in the extreme. Due to the imposition of even stricter milk quotas from April 1987, the dairy herd is being removed from the farm, the best cows and all the quota being absorbed by another herd belonging to the same owners. This will mean an entirely arable plot, with the exception of the marsh and the Church Meadow. It is to be hoped that these forebodings will not be realised, and that, with the possibility of less intensive agriculture, perhaps the hedges might be allowed to grow a little bigger!

Acknowledgements

The author wishes to thank the East Anglian Real Property Company for permission to continue with the Common Bird Census on their Cranworth farm, and also thanks the Eglington family before them. Thanks are also due to the BTO for allowing reproduction of the maps.

References

BULL, A. L., MEAD, C. J. & WILLIAMSON, K. 1976 Bird life on a Norfolk Farm in Relation to Agricultural Changes. *Bird Study* **23**, 163-182.

HYDROID COLLECTING FROM INTERTIDAL POOLS AT HOLME NEXT THE SEA, NORFOLK

P. F. S. Cornelius

Zoology Department, British Museum (Natural History), London.

Introduction

Hydroids comprise an order of primitive and colonial marine animals. They occur commonly offshore but only a few species grow intertidally. An intertidal location at Holme next the Sea, near Hunstanton, is remarkable for the number of offshore species that can be collected stranded in pools. Collection is both convenient and very cheap compared with more normal methods involving diving or dredging from research ships, and a number of species have been studied here.

Hydroids and their medusae

Hydroids form the Order Hydroida in the cnidarian (formerly 'coelenterate') class Hydrozoa. They are almost all marine, and are closely related to the better- known solitary *Hydra* which lives in fresh water. Unlike *Hydra*, however, the individuals or polyps remain linked through a common tubular gut resulting in the formation of a delicate branching colony. In almost all species the soft tissues are invested in a thin tube of perisarc, formed from a flexible chitinous substance, which both supports the colony and protects it from most would-be predators. One kind of polyp, the hydranth (Fig. 1), catches and digests prey, another produces gametes, and still other, smaller polyps present only in some species have other functions. In many families of hydroids the perisarc extends around the hydranth to form a protective cup. These families are grouped together as the Suborder Thecata in distinction from the Athecata which lack a cup.

The aspect of hydroids which is perhaps of greatest interest is their life cycle. The following pattern is characteristic of nearly all families. A hydroid colony vegetatively produces small jellyfishes or hydromedusae (often just called 'medusae'), typically one to three centimetres in diameter when fully grown (Fig. 2). These are carnivorous and swim for several weeks among the plankton, dispersing the species widely. They in turn produce male and female gametes from which minute free-swimming larvae result. Each larva, or planula, if it survives, settles and grows into a new colony. A good recent account of both the structure and the way of life of hydroids is that of Kershaw (1983) and another, giving greater details, will be provided by Cornelius & Ryland (in press). The very much larger 'true' jellyfishes familiar in coastal waters are not closely related and comprise a different Class, the Scyphozoa.

The hydroids of Norfolk coastal waters

The hydroids of the Norfolk coast and nearby North Sea have been documented in some detail by Hamond (1957, 1963a) and Hamond & Williams (1977). These papers together list 79 species of hydroids and medusae. Forty-eight form erect colonies, and the remainder are either stolonal (creeping) in growth habit or are known in Norfolk waters only from the medusa stage. The 79 species represent most of those typical of the hydroid fauna of the southern North Sea. More comprehensive works on the hydroids and hydromedusae of this area are those describing the fauna of Denmark (Kramp, 1935), the Netherlands (Vervoort, 1946), Belgium (Leloup,

Trans. Norfolk Norwich Nat. Soc.
1988 **28**(1), 72-78.

Fig. 1 A single hydranth on a colony of *Obelia longissima*, from a specimen collected at Holme, April 1985. Note the delicate cup or theca into which the hydranth can retract. Length of theca *c.* 0.3 mm.

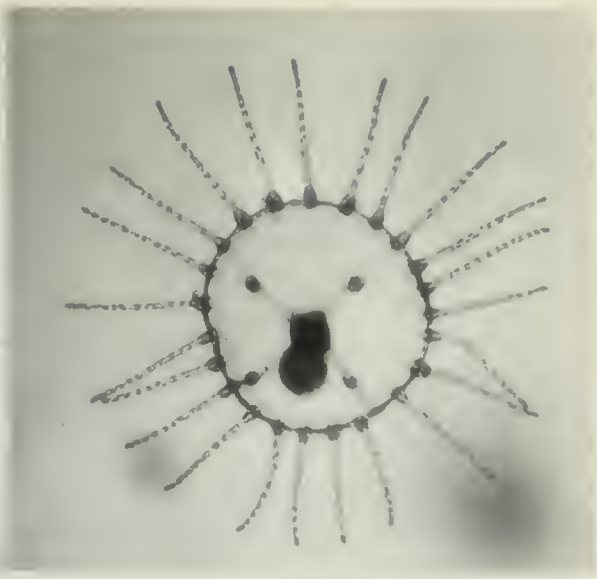


Fig. 2 Medusa stage of *Obelia longissima*, six days old, reared at Holme from a locally-stranded colony. Diameter of disc 0.7 mm.

1952) and the whole of the North Sea (Broch, 1928). A guide to the hydroid stages of all but the most minute British species will soon be available (Cornelius & Ryland, in press); and another will describe both hydroid and medusa stages of all temperate-water western European thecate hydroids and their medusa stages (Cornelius, in prep.).

Hydroid strandings on the shore

Since few hydroids are truly intertidal their collection presents difficulties. Dredging and trawling use boat time and are consequently expensive. Further, most colonies come up damaged or moribund in the bag of the dredge or trawl and it is often hit-and-miss whether the desired species are obtained. SCUBA diving also is rather costly, again in both time and equipment. At times SCUBA can be extremely useful if the diver knows the hydroids well enough to discriminate the various species, but not all hydroid specialists are divers. In the southern North Sea strong coastal currents often make the water turbid and along the Norfolk coast diving is difficult for part of the tidal cycle. Hamond's (1963b, p. 5) comment that in this region SCUBA diving becomes a practicable way of collecting marine benthos for only about half an hour at slack water is somewhat over-cautious but reflects the difficulties that might occur in some places along the Norfolk coast.

Many species of hydroids form large, bushy colonies offering some resistance to current action. Following rough seas many of their colonies are detached or portions broken off and thrown up on the shore in huge quantities, at times partly colouring large areas of the shore. Hamond (1957, p. 318) noted Garstang's (1905, p. 13) observation that in the southern North Sea 'So great is the disturbance of the sea bottom during . . . winter gales on the shallower central grounds such as the Dogger and Well (*sic*) banks that hydroids, which are so abundant in these

localities, are rolled by wave-action into compact fibrous balls from 4 to 8 inches (10-20 cm) in diameter'. The 'balls' consist of dense tangles of long dead hydroids and in practice are more sausage-shaped than spherical by the time they become stranded. Hamond (1957) recorded that one such accumulation washed up at Morston Creek comprised the remains of no less than 24 species of hydroid. In the centre there was a specimen of *Thuiaria thuja*, a species which has been recorded no closer to the Norfolk coast than off the Farne Islands, 250 km to the north (Cornelius, 1979; Dyer *et al.*, 1983). Hamond deduced that hydroid colonies can be carried considerable distances by coastal currents.

Such masses of hydroids are common on the Norfolk coast, especially following northerly winds. But colonies which are live are usually found stranded individually, and may have a closer origin. These colonies are often in fresh, undamaged condition and are entirely suitable for serious zoological study (Fig. 3). Marine currents often seem to crudely sort the flotsam for in some places hydroids are washed up more frequently than at others and many may collect in certain places. Such accumulations often occur just inside bay-head spits and similar promontories near the mouths of estuaries, but local conditions are varied and good localities have to be found by trial and error. One particularly good locality forms the subject of this note.

The pools at Holme

Live colonies of an exceptional variety of hydroids are regularly stranded in an extensive series of intertidal pools at Holme-next-the-Sea, near Hunstanton. In his useful papers Hamond recorded many hydroids from the Hunstanton area but did not mention the nearby intertidal pools at Holme. The pools are near the position indicated on maps as Gore point (grid ref. TF703449) though the Point itself, formerly comprising an intertidal sand-bank, seems to be no longer present. The pools extend over approximately the middle third of the shore as exposed during average spring tides. They range in size from a few square metres to perhaps 400 sq m, and in depth from 10 cm to about 1 m. The substratum in which the pools occur is a horizontally-bedded and rather firm peat which includes the fossilized remains of numerous trees, overlying a bluish-grey bed of clay. There are additionally at Holme numerous shallow pools in the sand in which drifted hydroids collect. Nearly at the eastern extent of the pools there is an old wreck around which specimens also collect, but the pool surrounding a smaller wreck some 200 m south-west of the first is usually much less productive.

Often some of the pools are half filled with drifted and largely undamaged hydroid colonies (Fig. 3). Collecting seems to be better in the autumn than in the spring and living colonies of most of the species listed here (Table 1) can be collected at least as late in the year as the first half of November.

Collecting is better on some days than on others. Calm days are best, when the surface of the pools is unruffled and a clear view can be obtained of the submerged colonies. Collecting is best following spring tides. At and close to neap tides the pools are only partially uncovered or not uncovered at all when collecting from them is impossible. Collecting is best also following strong winds from the quadrant NW to NE, which evidently bring the detached colonies onshore. Winds from the opposite quadrant greatly reduce the quantity and variety of stranded hydroids in the pools.

Fig. 3 An accumulation of hydroid and bryozoan colonies of offshore origin stranded in an intertidal pool at Holme. Centrally is a live, fertile colony of *Sertularia cupressina c.* 150 mm in length.

Hydroid species found

The species found to date during my brief visits to Holme are listed in Table 1. The length of the list gives an impression of the unusual potential of this locality for providing easily-collected specimens of this predominantly offshore group. The greatest variety occurs in autumn, but most of the species found then can occasionally be found in the spring. Most of the species form large, conspicuous colonies but some are minute epizoic forms growing on larger hydroids and other substrata. Only six are commonly found growing intertidally.

Perhaps the most notable species in the list is *Obelia bidentata* which occurs all round the world in warm coastal waters. Within the British Isles it is confined to the south-eastern corner and in my experience it is nowhere so easy to collect in Britain as in these intertidal pools. The occurrence of this species here is perhaps related to the high summer sea temperatures along this coast, which in places are the warmest in the British Isles (Garstang, 1901). In October 1982 small colonies were found growing on part of a wreck in one of the pools, probably the first record of intertidal growth of this world-wide species. However, although there were several small colonies it is unlikely that they would have survived the cool winter temperatures typical of Norfolk shores.

On many occasions large and virtually undamaged colonies of species hitherto poorly represented in the British Museum (Natural History) collection have been collected. Thus the first good illustration of the large and beautiful colony of *Obelia bidentata*, first described so long ago as 1875, has been prepared from such a specimen stranded at Holme (drawn by Mrs S. Chambers, in Cornelius, in press: also in Cornelius, in prep.).

Table 1. Species of hydroids collected in the autumn from intertidal pools at Holme next the Sea, Norfolk. All were collected in living condition from stranded material unless otherwise stated, and the records refer to whole colonies, or to sizeable fragments, in good condition. Three species were also collected in the spring, as noted under comments.

Species	Names used in Hamond (1957, 1963a), Hamond & Williams (1977), if different	Comments
Eudendriidae		
Eudendrium rameum		Occasional
E. ramosum		Occasional
Campanulariidae		
Gonothyraea loveni	*Campanularia*	Occasional
Hartlaubella gelatinosa	*Campanularia, Laomedea*	Common, especially following strong onshore winds. Occasional in spring.
Laomedea flexuosa		Common on fucoids
Obelia bidentata	*Laomedea bicuspidata*	Common; best known U.K. locality
O. dichotoma		Common on *Flustra*
O. longissima	*Laemedea longissima, Obelia dichotoma* (part)	Common. Sometimes abundant in spring.
Rhizocaulus verticillatus	*Campanularia*	Common, especially following strong onshore winds
Phialellidae		
Phialella quadrata		Occasional
Campanulinidae		
Calycella syringa		Common, especially on *Sertularia* cf. *argentea*; fertile early October, hydranths possibly regressing soon after; epizoic on other hydroids
Lafoeidae		
Filellum serpens		Common on *Abietinaria abietina*
Lafoea dumosa		Common
Haleciidae		
Halecium beanii		Occasional
H. halecinum		Common
Sertulariidae		
Abietinaria abietina		Common
A. filicula		Occasional
Diphasia attenuata/rosacea		Common
Hydrallmania falcata		Common
Sertularia cf. *argentea*	*S. cupressina* sens. lat.	Common. The commonest hydroid in spring
S. cupressina s. str.		Common
S. distans	*S. gracilis*	Common, but usually moribund
Plumulariidae		
Kirchenpaueria pinnata		Common on fixed structures
Nemertesia antennina		Common
N. ramosa		Common
Plumularia setacea		Occasional

Origin of the stranded material

It is not known for certain where the hydroids in the Holme pools come from. One fairly regular species. *Rhizocaulus verticillatus*, was said by Hamond (1957) to be common 65-80 km offshore but to be 'not at all common' locally in his experience from coastal and offshore dredging. The possibly long transport of *Thuiaria thuja* to the Norfolk coast was noted already. It is well known that hydroid colonies can drift long distances and remain alive (Cornelius, 1981) so that remote origins of at least some of the Holme material are not excluded. However, particularly in late autumn a number of inshore trawlers operate along the coast 1-2 km offshore from Holme and it is possible that some of the colonies eventually stranded are detached by their trawls and so stranded close to their point of origin.

Conclusions

Holme offers easy collection of a wide variety of hydroids that cannot normally be collected onshore, thus effecting considerable savings of time and expense. I know nowhere else where offshore hydroids can be collected so easily and in such good condition. The excellence of the Holme area as a locality for wind-drifted birds is well known to ornithologists. But in the less glamorous world of the hydroid naturalist it is prominent too, as an unusually exciting collecting place for current-drifted hydroids.

Acknowledgements

I am grateful to J. Newton and W. Boyd, past and present wardens of the Holme Dunes Nature Reserve, and to Miss R. Roberts, for hospitality for part of the time while at 'The Firs' and for use of laboratory space there; and to Dr and Mrs R. B. Williams for introducing me to the cnidarian collecting possibilities of the Norfolk coast. I am grateful for occasional help with collecting during certain of my short visits to Holme to my family, in whose time much of the work at Holme was done; and for help in both field and laboratory to Dr C. Östman, University of Uppsala, and Dr A. Svoboda, University of Bochum. I am grateful also for comments on the draft of this paper received from Drs R. Hamond, R. G. Hughes, R. W. Ingle, A. G. Irwin and R. B. Williams.

References

Broch, H. 1928 Hydrozoa I. In Grimpe, G. & Wagler, E. (editors) *Die Tierwelt der Nord- und Ostsee* **3b**, 1-100.

Cornelius, P. F. S. 1979 A revision of the species of Sertulariidae (Coelenterata: Hydroida) recorded from Britain and nearby seas. *Bull. Br. Mus. Nat. Hist.* (Zool.) **34**, 243-321.

Cornelius, P. F. S. 1981 Life cycle, dispersal and distribution among the Hydroida. *Porcupine Newsl.* **2**, 47-50.

Cornelius, P. F. S. (in press) European *Obelia* (Cnidaria, Hydroida): systematics and identification. *Bull. Br. Mus. Nat. Hist.* (Zool).

Cornelius, P. F. S. (in prep.) West European thecate hydroids and their medusae. *Linn. Soc. Syn. Br. Fauna.*

Cornelius, P. F. S. & Ryland, J. S. (in press) Hydrozoa. *In* Ryland, J. S. & Hayward, P. J. (editors) *An introduction to the marine fauna of the British Isles.* Oxford: Oxford University Press.

Dyer, M. F., Fry, W. G., Fry, P. D. & Cranmer, G. J. 1983 Benthic regions within the North Sea. *J. Mar. Biol. Ass. U.K.* **63**, 683-693.

Garstang, W. 1901 Marine zoology. *In* Doubleday, H. A. (ed) *The Victoria history of the counties of England. Norfolk. Volume I.* London: Constable. pp. i-xx, 1-351. (pp. 77-86).

Garstang, W. 1905 The natural history of the North Sea. President's address. *Trans. Norfolk Norwich Nat. Soc.* **8**, 5-14.

Hamond, R. 1957. Notes on the Hydrozoa of the Norfolk coast. *J. Linn. Soc.* (Zool.) **43**, 294-324.

HAMOND, R. 1963a Further notes on the Hydrozoa of the Norfolk coast. *Ann. Mag. nat. Hist.* **(13) 6**, 659-670.
HAMOND, R. 1963b A preliminary report on the marine fauna of the north Norfolk coast. *Trans. Norfolk Norwich Nat. Soc.* **20** (1), 2-31.
HAMOND, R. & WILLIAMS, G. B. 1977 The Ctenophora, Scyphozoa and Anthozoa of Norfolk, with additional notes on the Hydrozoa. *Trans. Norfolk Norwich Nat. Soc.* **24**, 58-74.
KERSAW, D. R. 1983 *Animal diversity*. Slough, Middlesex: University Tutorial Press.
KRAMP, P. L. 1935 Polypdyr (Coelenterata). I. Ferskvandspolypper og goplepolypper. *Danm. Fauna* **41**, 1-207.
LELOUP, E. 1952 Coelentérés. *Faune Belg.* 283 pp. Brussels: Institut Royal des Sciences Naturelles.
VERVOORT, W. 1946 Hydrozoa (CI). A. Hydropolypen. *Faun. Ned.* **14**, 1-336.

1987 WEATHER SUMMARY

N. W. K. Brooks
79 The Street, Old Costessey, Norfolk.

January - With a mean temperature only just above freezing it was the third coldest January this century. The 12th, with maxima away from the coast and the extreme east below -7.0°C, was almost certainly the coldest day in Norfolk since at least 1895. Snowfall was heavy on the 12th and 13th with a level snow depth of 45 cm in parts of Norfolk. A "snow devil" (a small whirlwind made visible by flying snow) was observed between Drayton and Costessey on the 10th. The screen minimum of -14.9°C at Morley on the 13th was the year's lowest.

February—A very dry month with temperatures close to normal. Ice crystals in the upper atmosphere produced a fine display of solar haloes, arcs, and mock suns on the 24th.

March—The coldest since 1970. Plant growth by the end of the month was more belated than in any March since the last war (with the exceptions of 1947 and 1963). A sudden gale on the 27th produced wind speeds of up to 75 mph causing widespread though mainly minor damage.

April—The warmest since 1949 with a mean temperature 6.4°C higher than that of March. Many parts of the county did not record a single air frost. The maximum temperature of 24.4°C on the 29th, although equalled in 1949, was the highest recorded in April since 1946.

May—In great contrast to April, May had no fewer than 22 days with winds reaching Norfolk from the still cold North Sea. Consequently the mean temperature was below normal and the rainfall above average. Air frost was absent from all localities, although slight ground frost occurred on as many as 11 nights.

June - The dullest since 1953 and wetter and cooler than normal. Rain falling on 22 days caused many parts of the county to record over double their expected total. Although some form of domestic heating was needed, during the evenings at least, until the fourth week, summer warmth arrived on the 27th with a maximum of 26.7°C on the 28th and 27.9°C on the 29th.

July - The dullest for 7 years and much wetter than normal with some parts of the county receiving double their average monthly rainfall. Maximum temperatures which exceeded 21°C on as many as 12 days to the 15th, only managed to attain this figure on one day thereafter.

August - August was the wettest for 24 years, and in a few localities, 33 years. Most of the months's rainfall occurred on the 25th and 26th, with the highest daily total being an exceptional 83.5 mm at Acle on the 25th. Dust of Saharan origin was mingled with the light rain that fell on the 17th. There were few warm days, although the 21st achieved a maximum of 27.9°C. It was the dullest August for 7 years.

September - Slightly warmer and sunnier than normal. Although rain fell on 19 days, rainfall was below average in nearly all parts of the county. However the ground remained unusually wet throughout the month. This fact certainly contributed to a near total absence of ground frost.

October - October 1987 will certainly enter local folk-lore for the massively destructive storm that lashed eastern parts of the county with frightening ferocity during the early hours of the 16th. Although the damage and uprooting of trees was not as extreme as in counties to the south, it was nevertheless devastating. The combination of saturated ground and nearly complete leaf burden, meant that many trees had a hopeless fight maintaining a "hold" in the ground. A few days after the storm it was noticeable that much tree foliage presented a "scorched" and dead appearance. It is most likely that this was caused by the rain, which fell during the storms, containing a high salt content picked up from the sea. The highest gust reached in Norfolk was 90 mph at Hemsby—hurricane force on the Beaufort Scale. It was one of the worst storms of the century in much of the county, although as recently as 2nd-3rd January 1976 there was another extreme gale which occurred, of course, when the trees were leafless and there was less damage. The month was much wetter, and rather colder than normal. Further North African dust fell with rain on the 27th.

November - Dull and quiet with rather below average rainfall. The first slett of winter was observed early on the 23rd (exactly the same date as 1986). Quite cold and foggy conditions developed late in the month, and a screen minimum as low as -5.4°C was recorded on the 29th.

December - Rather cold until mid-month, after which very unsettled and mild conditions prevailed. The 15th saw the end of a period of rather cold and dull weather that had persisted since the 21st November without a single day reaching 10°C. From the 16th to the close of the month only two days failed to reach or exceed this figure, with a remarkably high maximum of 14.1°C reached on the 19th. It was the driest December since 1963 although the ground remained wet throughout. Slight snow was observed on 3 days. Although sunshine was very deficient, Christmas Day was one of the sunniest this century.

The Year - With a mean temperature of 9.1°C, 1987 was the fourth year in succession to be cooler than normal. In most of the county it was the wettest year since 1968, and the dullest since 1978.

1987 WEATHER

	MEAN TEMPERATURE °C		NO. OF AIR AND GROUND FROSTS		SUNSHINE HOURS	
	1987	Avg.	1987	Avg.	1987	Avg.
Jan.	0.3	3.5	20/25	11/19	36.9	51.2
Feb.	3.3	3.2	15/21	12/18	72.2	66.8
March	3.5	5.3	16/24	7/17	94.9	100.6
April	9.9	7.3	1/11	4/14	150.6	154.2
May	10.5	10.9	0/11	1/6	197.3	193.5
June	13.0	14.0	—	rare	120.6	202.6
July	16.0	16.0	—	very rare	167.4	193.9
August	15.6	16.2	—	very rare	146.5	186.7
Sept.	14.2	13.9	0/1	rare/1	159.6	149.8
Oct.	10.1	10.4	4/10	1/6	125.6	109.1
Nov.	6.7	6.5	3/10	5/12	47.8	67.6
Dec.	5.9	4.2	9/16	9/17	35.1	50.5
Year	9.1	9.3	68/129	49/109	1354.5	1526.5

	RAINFALL mm		DAYS WITH SNOW/HAIL		DAYS WITH THUNDER	
	Costessey	Taverham				
	1987	Avg.	1987	Avg.	1987	Avg.
Jan.	58.0	58.4	12/1	5/1	0	rare
Feb.	23.3	45.0	6/0	4/1	0	rare
March	45.6	42.7	10/2	3/1	1	rare
April	40.0	39.9	0/0	1/1	2	1
May	53.9	41.7	0/5	rare	1	2
June	100.2	43.2	0/1	very rare/rare	1	3
July	66.2	57.9	—	—/rare	0	3
August	118.9	54.9	—	—/rare	2	3
Sept.	35.1	53.6	—	—/rare	2	2
Oct.	131.1	62.5	0/1	rare	3	1
Nov.	54.4	71.1	1/0	2/1	0	rare
Dec.	32.1	57.7	3/0	3/1	0	rare
Year	758.8	628.6	32/10	18/6	12	15

Averages quoted above are for 46 years to 1984 for rainfall, otherwise for 17 years to 1984.

NOTES FOR AUTHORS

The Transactions are published each year in the spring. Manuscripts should be with the editor by 1 December of the previous year.

Authors are requested to write to the editor for a copy of *Instructions for Authors* **before** writing a paper.

This issue of the *Transactions* may be used as a general guide to content and format, but it is advisable to consult the editor before preparing final text, figures etc. Failure to do this might result in delayed publication.

The editor will be pleased to discuss proposals for papers by any member, and will help novice authors with the production of material.

All communications, including manuscripts for publication should be sent to:
Dr A. G. Irwin, Castle Museum, Norwich, NR1 3JU.

NORFOLK & NORWICH NATURALISTS' SOCIETY

Patron: Her Majesty the Queen

The County's senior natural history society. It has for its principal objectives the practical study of natural science, the conservation of wild life, the publication of papers on natural history, especially those related to the county of Norfolk, arranging lectures and meetings and the promotion of active fieldwork. Specialist Groups cover most aspects of the county's flora and fauna.

Annual Subscription Rates:
Junior £3.00
Ordinary £6.00
Family £7.50
Affiliation £15.00

Publications:
May: Transactions
August: Bird & Mammal Report
Quarterly newsletter: 'Natterjack'

Secretary:
A. L. Bull
Hillcrest
East Tuddenham
Dereham
Norwich NR20 3JJ.

Membership Secretary:
C. Dack
12 Shipdham Road
Toftwood
Dereham
Norfolk NR19 1JJ

CONTENTS

		Page
Presidential address — Learning through nature	*T. B. Terry*	1
Plant notes for 1987	*A. L. Bull*	10
The lichen flora of Norfolk	*P. W. Lambley*	13
The work of Walter Lowne, taxidermist of Great Yarmouth	*P. A. Morris*	33
The great storm of 1987	*G. M. Haggett*	44
The marine fauna of the North Norfolk salt marshes and their ecology	*C. L. J. Frid*	46
The current status of the sea anenome *Nematostella vectensis* in England — a correction	*R. B. Williams*	50
The distribution and status of lizards in Norfolk	*J. Buckley*	51
Recent records of invertebrates	*R. E. Jones*	61
Birds on the farm — a twenty-five year study	*A. L. Bull*	63
Hydroid collecting from intertidal pools at Holme-next-the-Sea, Norfolk	*P. F. S. Cornelius*	72
1987 Weather summary	*N. W. K. Brooks*	78

ISSN 0375 7226 *Printed by Witley Press Ltd., Hunstanton* £3.00

Norfolk Bird & Mammal Report 1987

Norfolk Bird Report — 1987

Editor: MICHAEL J. SEAGO
County Recorders: P. R. ALLARD, D. A. DORLING & P. D. KIRBY
Editorial Assistants: P. R. ALLARD, P. R. CLARKE, G. E. DUNMORE, M. FISZER, J. B. KEMP and DR. M. P. TAYLOR

Editorial	81
Breydon — A Century of Protection	87
Black-winged Stilts Breeding at Holme	89
Great Bustards	97
Red-rumped Swallows in Norfolk	98
Penduline Tit: New to Norfolk	100
Slender-billed Gulls: New to Norfolk	101
Lapwing Breeding Survey	103
The Wash — Mecca for Waders	105
Ringing Report	112
Classified Notes	118
Contributors, Photographers & Artists	151

Norfolk Mammal Report — 1987

Editor: REX HANCY

Editorial	152
A History of Coypus in Britain	154
Classified Notes	158
Contributors	168

Published by THE NORFOLK & NORWICH NATURALISTS SOCIETY, Castle Museum, Norwich NR1 3JU (*Transactions* Volume 28 Part 2 August 1988) in conjunction with NORFOLK ORNITHOLOGISTS ASSOCIATION, Aslack Way, Holme-next-Sea, Hunstanton PE36 6LP.
ISSN 0375 7226 **Price £3.00**

NORFOLK BIRD REPORT 1987

- 2 SEP 1988
EXCHANGED
LIBRARY

Editorial

The Council of the Norfolk & Norwich Naturalists Society, in conjunction with Norfolk Ornithologists Association, is pleased to present the annual report on the birds of Norfolk.

Review of the Year: Severe weather in **January** with heavy snowfall and drifting caused the dispersal of the north Norfolk Pinkfeet armies present since December 1986. Most inland waters froze and ice was thick enough on some rivers to affect shipping. A record 6,100 Bewick's Swans assembled on the Ouse Washes having fled from similar conditions on the near Continent; other hard-weather specialities included widespread Smew and Goosanders as well as 200 Scaup off Heacham/ Hunstanton, but few Eiders. Unusual passerines included Firecrest at Holkham, 125 Lapland Buntings at Burnham Norton, Richard's Pipit in the Holkham marrams, 25 Shorelarks on Blakeney Point and a reasonable scattering of Waxwings. Other oddities included Grey Phalarope under Breydon bridge, Great Skua scavenging the tidelines on the Wash and a wintering Dotterel at Cley until 9th when severe weather had set-in.

Spells of mild and cold weather occurred in **February** which was generally slightly milder and sunnier than normal. The appearance of 2 Great Bustards at New

Buckenham brought sunshine to many observers who had previously been restricted to viewing the display case in Norwich Castle Museum. This particular group of 7 indigenous specimens including the last of the Norfolk race is a reminder of the days when two 'droves' of these magnificent birds (totalling almost 70 individuals) roamed the barren brecks about Swaffham and Thetford. However, the exciting events early in 1987 enabled many birders to add this splendid bird to their life list. The month also saw 310 Bean Geese in the Yare Valley and 470 Whooper Swans on the Ouse Washes.

The first half of **March** was the coldest since 1970, contrasting with a mild wet close to the month. Rather a quiet time birdwise although 232 White-fronts at Holkham and 240 Black-tailed Godwits on the Ouse Washes at Welney where an American Wigeon made a brief appearance. Also of note a Black-bellied Dipper at Hunworth.

April was the warmest for nearly 40 years especially from mid-month onwards. Many regular migrants such as Little Gulls, Black Terns, Ruffs, Firecrests, Black Redstarts and Ring Ouzels appeared in larger numbers than normal while rarities included Red-rumped Swallow, Alpine Swift, Tawny Pipit, Hoopoe, Serin at Wells again where it summered, Black Kite, Night Heron and Penduline Tit at Hickling — a county first.

Cool northerly winds were prevalent for substantial periods in **May** which was much colder than average. Yet another arrival of Bluethroats was added spice for coastal watchers together with Thrush Nightingale, 2 Marsh Warblers, Icterine Warbler, Tawny Pipit, Ortolan Bunting and Hoopoe.

The most unexpected events were not just the arrival but the successful breeding of a pair of Black-winged Stilts at Holme and the appearance of a pair of Slender-billed Gulls — another county first — in the Cley/Blakeney harbour area which were observed mating but alas not breeding. Invariably a varied month this year saw the arrival of Ring-necked Duck, Purple Heron, Black Kite, 2 Red-footed Falcons, Spotted Crake, Corncrake, Kentish Plover, 2 Broad-billed Sandpipers, Wilson's

Phalarope, Caspian Tern and White-winged Black Tern. More regular spring migrants (Dotterel, Temmink's Stint and Wood Sandpiper) also appeared in good numbers.

A cold wet **June** was the cloudiest for over 30 years, factors not assisting breeding birds. Nevertheless Hobbies, Marsh and Montagu's Harriers bred successfully, but Goshawks yet again suffered at the hands of the mindless minority. Avocets continued increasing, but Cetti's Warblers were reduced by the severe winter — a problem for any small passerine. On the coast Little Terns increased. At the same time it is depressing to note that Common Terns in the county have declined to a third of the numbers breeding just 15 years ago. Eight booming Bitterns made an important contribution to Britain's tiny breeding population and a total of 222 Herons nests were counted.

Mid-summer rarity sightings included Whiskered Tern at Pentney, White-winged Black Tern near Methwold, Rose-coloured Starling at Stalham, Woodchat Shrike at Holme, American Wigeon at Cley, Broad-billed Sandpiper at Breydon (where else!) and a long-staying Purple Heron at Welney.

A warm sunny start to **July** deteriorated to a predominantly dull and wet finish. Most of the interest focussed on early returning waders with Red-necked Phalaropes at Breydon, Holme and Snettisham; Marsh Sandpiper at Cley; Pectoral Sandpipers at Hickling and Wissington BF and the beginning of a heavy Wood Sandpiper passage.

August, the wettest for 24 years, produced rather low temperatures. Much of the ornithological interest centred round the bout of rain and northerly winds beginning on 25th which produced a heavy fall of migrants along the north coast. Large numbers of Willow Warblers, Garden Warblers and Pied Flycatchers were accompanied by Wrynecks, Icterine Warblers, Barred Warblers, Red-backed Shrikes, an incredible 7 Greenish Warblers and an overdue Great Snipe in the suaeda at Blakeney Point.

The month also saw visits by Red-necked and Wilson's Phalaropes, Pectoral

Sandpiper and Night Heron.

Less rain than average fell in **September** which was also marginally warmer and sunnier than usual. It was not an outstanding month birdwise: only small numbers of Shearwaters and Petrels were observed offshore, but the first Yellow-browed Warblers, of a moderate influx, started to appear later in the month and a Tawny Pipit was on Blakeney Point. Otherwise a Blue-winged Teal spent over a fortnight at Cley where a Pectoral Sandpiper was also found. A most unusual event was an early arrival of Pink-footed Geese: first party appeared by 18th.

October was the wettest since 1939, though sunshine levels were still above normal. The 9th was the wettest October day on record. By mid-month the Ouse Washes had high bank-to-bank flooding and the A1101 Wash Road was impassable. The hurricane in mid-month made national news and caused widespread devastation in southern Britain, but Norfolk was relatively unscathed when compared with neighbouring Suffolk. Only unusual birds resulting from the storm were 6 Sabine's Gulls and 2 Grey Phalaropes, a disappointing selection compared with other areas including not too distant Graffham Water.

A spell of south-easterlies early in the month brought in a fine selection of eastern rarities: Olive-backed Pipit, Dusky Warbler and Ortolan Bunting to Blakeney Point; Radde's Warbler at Wells and a few Red-breasted Flycatchers. There was a late Hoopoe at Old Catton on 24th.

A milder than normal **November** although sunshine and rainfall were both below normal. Low pressure over Europe brought colder conditions from 20th. Strong NE to NW winds persisted for some time and the month ended with severe frosts. Thirty years ago bird-watchers hung up their binoculars by the end of September before realising the great potential of October for migrants. Nowadays it is appreciated that November too can have its moments. This year brought in an Isabelline Shrike to Wells — a county second along with a late Yellow-browed Warbler; Dusky Warbler at Happisburgh; Pallas's Warblers at Blakeney Point, Paston, Waxham, Wells and Holkham including the latest county date on 29th; Olive-backed Pipit at Sheringham and Red-rumped Swallows at Winterton and Happisburgh formed part of a nationwide influx.

More predictably there were varying numbers of Little Auks moving offshore together with sizeable Little Gull movements. As usual Holkham Bay held a gathering of up to 14 Slavonian Grebes. Finally, a Night Heron spent a few days frequenting gardens at East Rudham.

Although the first two weeks of a mainly dry **December** were colder than normal, mild conditions prevailed from mid-month. Wildfowl counts on the Ouse Washes included 3,200 Bewick's Swans and a record 504 Whooper Swans. Groups of White-fronts, Bean and Barnacle Geese appeared in several areas while Black Brents were at Cley and Lynn Point and a fine adult Red-breasted Goose wandered in the Cley/Salthouse/Blakeney area in company with Brents. Co-ordinated counts along the North Coast and Wash produced a figure of 17,000 Pink-footed Geese on 20th.

The massive numbers of bird-watchers observing rarities in the county nowadays usually produce an abundance of other interesting observations. In the centre of Norwich during January following the arrival of Waxwings up to 35 Siskins together with wintering Chiffchaffs, Redwings and Fieldfares were all reported. At Hardley Flood the prolonged spring-time stay of a Ring-necked Duck resulted in sightings of Golden Oriole, 16 species of waders including Temmink's Stint together with Little Gulls, Black and Arctic Terns. The appearance of Great Bustards at New Buckenham early in February brought many birders and the discovery of a roost of up to 15 Long-eared Owls. A Penduline Tit close to Weaver's Way long-distance

footpath at Hickling April 4th-10th attracted Black Kite observations. The Happisburgh Dusky Warbler which stayed 5 days during the second week of November resulted in the sighting of a Red-rumped Swallow there on 11th, Firecrest on 7th and a very late Willow Warbler the same day.

Although there were periods of calm during the year these were more than compensated for by many spells of action making 1987 one of the most entertaining of birding years (JBK).

International importance of The Wash: This estuary attracts vast numbers of waders and wildfowl, particularly because of its high food productivity and climatic factors. Whereas continental estuaries tend to freeze, The Wash does so less frequently due to relatively mild winters. Surveys such as the *Birds of Estuaries Enquiry* have highlighted the importance of our estuaries. Regular surveys by The Wash Wader Ringing Group give an excellent picture of the origins and migration patterns of waders using The Wash (see page 105).

Where an estuary holds 1% of the north-west European wintering population of one species the site will qualify for designation as a Special Protection Area (SPA) under the European Directive on the Conservation of Wild Birds and it may also be eligible for designation under the Ramsar Convention on wetlands of International Importance; Britain is a signatory of both these international treaties and under the SPA designation Government has legal obligations to protect such sites. The Wash was officially declared as an SPA in April 1988 and joins eight other estuaries or parts of estuaries around the coasts of Britain with the same protection. Many other estuaries also qualify for such treatment. It is hoped they too will be designated in the near future.

Despite their international importance many of Britain's estuarine habitats are under threat from a wide range of development proposals including tidal power barrage schemes and recreational developments. The Wash is no exception and for several years parts of the estuary have been under investigation for agricultural land reclamation schemes. There is now no need to increase the amount of land for agricultural production and while The Wash is no longer under immediate threat, the Ministry of Agriculture, Fisheries and Food has not yet completely withdrawn its proposals. It is essential that surveys such as those carried out by The Wash Wader Ringing Group continue. They provide vital evidence on the importance of these extremely rich habitats (Liz Dorling).

Recording: Records for the 1988 Report should be sent *by the end of January* to Michael J. Seago, 33 Acacia Road, Thorpe St. Andrew, Norwich NR7 0PP. *Late arrivals are not guaranteed inclusion in the current Report.* All observations should be submitted in the order followed by The 'British Birds' List of Birds of the Western Palearctic and *not* in diary form which creates very time-consuming situations. In order to minimise the work involved, records will not normally be acknowledged. The names of all contributors will be included in the Report.

Field descriptions of semi-rarities as listed in the 1983 Report (page 337) should also be submitted as such records are considered by the County Records Committee (B. Bland, G. E. Dunmore, S. J. M. Gantlett, S. C. Joyner, J. B. Kemp and R. Millington) prior to publication. Records of rarities considered by 'British Birds' Rarities Committee should be submitted with full details as soon as possible after observation and not left until the end of the year. Record forms for the submission of national rarities are available either from the Editor or from G. E. Dunmore (49 The Avenues, Norwich NR2 3QR).

Acknowledgements: Thanks are due to the following photographers and artists: N. Arlott, B. Bland, D. Bryant, N. Carmichael, P. R. Clarke, D. M. Cottridge, D. A. Dorling, A. L. Howes, R. Jones, C. R. Knights, T. Loseby, R. Millington, M. S. Read, D. Showler, R. Tidman, Dr. P. Wheeler, I. Willis and B. Wingrove. Among the vignettes is a selection by the late R. A. Richardson.

We acknowledge the assistance and co-operation of The Bird Information Service in allowing us to reproduce material first published during 1987 in their monthly magazine *Twitching*. For 1988 the magazine has been improved and re-titled *Birding World*. Regular features include a detailed round-up of all the previous months news, articles covering long-staying rarities, weather interpretation and reviews. Fully illustrated, it is available only on subscription (£15 pa) from Appletree Cottage, Marshside, Brancaster, King's Lynn PE31 8AD. Subscribers also have access to *Birdline*, the 24 hour rarity telephone information service.

Thanks are also due to Cley Bird Club, Norfolk Ornithologists Association, Norfolk Naturalists Trust, National Trust, Wildfowl Trust, Nature Conservancy Council, RSPB, Nar Valley Ornithological Society, G. E. Dunmore (for liaising with 'British Birds' Rarities Committee and acting as Secretary/Chairman of the local Records Committee), Mrs. M. Dorling, Mrs. S. F. Seago and all other contributors.

Breydon Water: A Century of Protection

Peter Allard

"It would be difficult to imagine" wrote the Paget brothers in 1834 "a spot more suitable to wildfowl and waders than Breydon affords consisting as it does of a sheet of water some miles in extent with shallow borders and mudflats and surrounded almost as far as the eye can reach by marshes. Even in the severest winters it is seldom completely frozen ... and it is then that the greatest numbers of fowl are secured. Almost benumbed with cold they flock together and while they sit in a compact mass to prevent the warmth of their bodies escaping, the gunner may in his flat-bottomed boat approach closely and with a single discharge of his gun effect a most extraordinary slaughter".

Breydon, over four miles long and nearly a mile wide, was prior to the passing of the first Wild Bird Protection Acts in 1880, an area where more rare waders and wildfowl had been collected than in any other locality in the country. Its claim to fame includes the first British examples of Red-crested Pochard, Caspian Tern, Pectoral Sandpiper and Broad-billed Sandpiper together with a catalogue of additions to the Norfolk List: Collared Pratincole, Gull-billed Tern, Sabine's Gull and Mediterranean Gull which was the first recognised British example. Within a short distance of the estuary may be added the first British records of Caspian Plover and Citril Finch.

Construction of the Acle New Road in 1832, Yarmouth to Reedham railway line in 1844 and the arrival of the first steam drainage mills in the 1850s all marked a change in the character of the adjoining marshland. However, Breydon muds continued attracting large numbers of waders and wildfowl. High prices were being paid by collectors for rarities and encouragement to violate the Protection Acts increased. To prevent illicit shooting a meeting of interested parties was held on March 3rd 1888 at No. 5 South Quay, Yarmouth, and it was agreed that the Breydon Wild Birds Protection Society should be established. H. E. Buxton of Fritton Decoy, was President and the committee of 16 included Sir Edward Newton of Lowestoft, W. A. Burdett Coutts, M.P. of Norwich, J. H. Gurney Junior of Keswick and an aged gentleman-gunner: Richard Fielding-Harmer who had taken many a rarity at Breydon.

This Society, perhaps the first of its type, pre-dates the Society for the Protection of Birds (the Royal assent came in 1904) which was formed a year later in 1889. Samuel 'Ducker' Chambers was appointed first Breydon Watcher in the spring of 1888 with a seasonal wage of £22. Field glasses coasting £1 8s 6d were purchased for his use. Chambers maintained a rough log-book and in the first year noted up to 6 Spoonbills on half a dozen occasions. Sadly, these splendid birds were still reaching local taxidermists. Several prosecutions were instituted and convictions obtained. Most notable case involved Albert Beckett, landlord of the Lord Nelson, who shot two Spoonbills in June of that year, the chief witness being the Breydon Watcher. Beckett pleaded guilty and was fined 40 shillings, but remarkably the prize was never forfeited. Upon his death both specimens began adorning Yarmouth Conservative Club smoke-room later passing to a Regent Road shop. Moth finally sealed their fate. Early one morning in 1952 both Spoonbills were returned to the estuary mounted on a piece of cork. In the shimmering heat haze one observer was convinc-

Publication of this feature has been subsidised by a donation from Nature Conservancy Council

ed the apparitions were genuine new arrivals from across the North Sea! 'Beckett's' Spoonbills were probably the last ones obtained at Breydon. The following Close Season a punt and houseboat were purchased for £8 and anchored in the centre of the estuary where Chambers lived all summer. He closed his diary in 1899 and George Jary was appointed official Breydon Watcher in 1900. By this time the Society was finding it increasingly difficult raising sufficient funds. The first year's subscriptions totalled £42 12s 6d, but by 1902 revenue had dropped to £12. The Society for the Protection of Birds (now the RSPB) came to the rescue with a substantial donation, the first of many and enabling the Breydon Society to maintain a seasonal Watcher during the Close Season.

George 'Newcome' Jary's diaries make interesting reading. No less than 17 Spoonbills were on the flats on April 27th 1901. Another great surprise was a Caspian Tern on August 9th 1910 which alighted on his punt moored close to the houseboat.

Breydon Wild Bird Protection Society was re-organised in 1921 following retirement of its original Secretary (H. P. Frederick). H. H. Halls of Norwich became Secretary, J. H. Gurney President and Dr. Sydney Long Treasurer. Following year the Breydon Society merged with Norfolk Wild Bird Protection Committee under the auspices of Norfolk & Norwich Naturalists Society founded in 1869. Jary retired after the 1927 season and William Betts became Watcher followed a year later by Walter Bulldeath.

Norfolk Wild Birds Protection Committee (which had replaced the small and separate Societies at Breydon, Blakeney, Wells and Wolferton) was transferred by mutual agreement in 1933 to Norfolk Naturalists Trust which had been formed in 1926. Bulldeath continued duties under Trust guidance until the outbreak of the Second World War in 1939. Following cessation of hostilities in 1945 Norfolk Naturalists Trust appointed Robin Harrison as part-time Breydon Warden. He was made a Special Constable and continued his duties for many years. Another highlight was recorded in 1962 when NNT reached a five-year agreement with adjoining landowners (including those at Berney and Burgh Castle) to create a shooting-free marshland reserve. Roger Coleman became marsh warden.

Discussions began in 1964 with local naturalists, wildfowlers, the Nature Conservancy and the relevant county and borough councils concerning the establishment of a Local Nature Reserve at Breydon with controlled shooting. Agreement was finally reached in 1968 and voluntary wardens from Yarmouth Naturalists Society and Yarmouth Wildfowlers Association regularly patrolled the 1,200 acre reserve. Increased bird-watching and the siting of hides overlooking high tide assemblies have brought great rewards in addition to the Spoonbills and Avocets which continue putting in appearances. Over 180 Spoonbills visited Breydon between 1947 and 1987, together with groups of up to 25 Avocets. 1975 Breydon arrivals included two 'firsts' for Norfolk: Terek Sandpiper and Greater Yellowlegs followed by American Golden Plover next year. Other rarities since then have included Caspian and Gull-billed Terns, Little Egret, Purple and Night Herons, Black Stork, American Wigeon, Ring-necked Duck, Greater Sandplover, White-rumped Sandpiper, Pectoral Sandpiper, Wilson's Phalarope and a succession of Broad-billed Sandpipers.

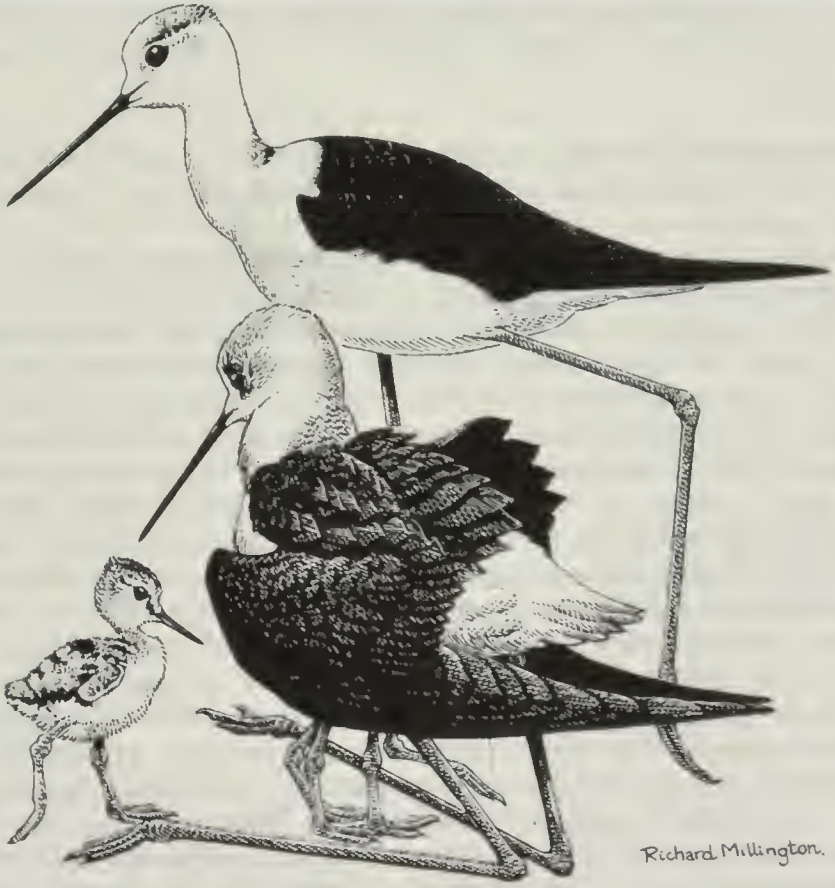
The acquisition in 1986 by RSPB of nearly 400 acres of marshes at Berney and management of the greater part of the estuary being handed over to them in this centenary year of the establishment of Breydon Wild Birds Protection Society is very apt and a milestone in the conservation of the estuary and its environs. Arthur Patterson, who immortalised Breydon in his fascinating volumes, would surely agree.

Black-winged Stilts breeding at Holme

Bill Boyd, Norfolk Naturalist Trust

A first look round Holme wader pools at 7.30 a.m. on 17th May was fairly unproductive. When the Assistant Warden took a second look at 9.00 a.m., however, he was amazed to see a pair of black-winged stilts feeding on Christie's Pool. In a short time he was communicating the news to the Warden, who appeared still dazed from the previous day's 24 hour County Birdwatch.

The reserve was shortly opening for the day, and stilts were big news for Norfolk. On the third weekend in May, considerable numbers of birders are on the north coast and a fair turnout could be expected when the news broke. The birds, meanwhile, were feeding and apparently relaxed, on Christie's Pool, where high banks and small area make for intimate viewing. The immediate priority was to arrange for reception and controlled viewing by numbers of people. CB radio links from reserve entrance to car park to hides helped smooth the flow and provided an impression of efficiency. The news was broadcast via a few calls to friends and the Bird Information Service, and in the time it takes to drive from Cley, people began to appear. At Holme, each hide overlooks a relatively small pool and it is always difficult for large numbers to view at once without disturbing the birds. Queues formed and time in the hides was limited to a few minutes each. There were however few complaints. By now the rain was falling solidly and the birds were skipping from pool to pool, but still providing better views than they would throughout the rest of their stay.



Publication of this feature has been subsidised by a donation from Mr. Christopher Cadbury

Of the two stilts one was larger, with pink-flushed underparts and blacker mantle, scapulars and wing feathers, all this indicating that it was a male. The other bird was slightly smaller, had a browner mantle and scapulars and this pointed to a female. Its greyer crown and neck also hinted at this. The descriptions in *Shorebirds* fitted these birds better than those in *The Birds of the Western Palearctic*. We jokingly remarked that they might breed, but were surprised that mating was observed at least four times that morning and afternoon. We were, however, delighted.

April and May 1987 were notable for the numbers of night herons and black-winged stilts turning up in Britain, the latter mainly in the south and west. At least 15 black-winged stilts were recorded in England, and an unprecedented 8 in Ireland. The species is in fact notable for vagrancy in some numbers in particular years. Perhaps because dry conditions have caused dessication of some of their breeding areas, though there may also be overshooting migrants in southerly winds. Breeding on the Continent occurs in a variety of wetland habitats including saltmarshes, saltpans, freshwater and brackish lakes and sewage farms.

There had been two stilts at Tring Sewage Farm (Hertfordshire) on the 16th. They departed during the evening and could have been the same birds that arrived at Holme. However, a second pair also turned up at Alvecote Pools (Staffordshire), appeared as if they were going to attempt breeding, but soon deserted the site.

At Holme next day, several hours were spent in vain looking for the birds, until they turned up in a flooded channel on the grazing marsh, feeding amongst the white flowers of brackish water crowfoot *Ranunculus baudotii*. Over the next few days they wandered a good deal, perhaps searching for good feeding areas or assessing potential nest sites. They were also observed on one of the dune slack pools, which differ from the wader pools in being sandy, lower in nutrients, and holding lower numbers of invertebrates, though there was still a good supply of common toad *Bufo bufo*, tadpoles.

Display: Reduced visitor numbers on the Monday allowed more time to observe the stilts. They fed busily throughout the day, with quick stabs at and under the surface and often moving in water above their 'knees'.

It seemed impossible to determine whether a feeding attempt had been successful or not owing to an absence of perceptible swallowing movements as can readily be seen in avocets. Certainly, there were many common toad tadpoles in Christie's Pool, but it was felt that it should have been possible to observe such prey being taken. There was some concern whether they were locating sufficient prey in the pools, which are not at their most productive in mid-May, particularly as the weather was remaining cloudy and cool, so maintaining low water temperatures. Yet the beautiful pair's ardour for one another remained undiminished and mating was observed on five occasions on the 18th. The mating-ceremony closely paralleled that in avocets. The female initiated mating by adopting a soliciting posture while the male was nearby and she maintained this position throughout. The male was then stimulated to commence his role. Standing to one side of his mate, he would dip his bill in the water, shake it (often wetting the female), and preen his breast, before walking behind her and repeating these actions on the other side. Sometimes there were further repetitions before the male stretched over her, beating his wings, and alighted with his tarsi on her back copulating briefly. As he dismounted they touched bills before separating, usually to resume feeding. With such long legs, alighting on the female's back was obviously precarious. Cn one occasion the male was unable to gain his balance. The male's red eye, always brighter than the female's, was observed to pulse extra bright as he copulated with her on another occasion.

Nesting: On the 19th, nest-building was noted on a small island in the Hun Pool that had been created almost inadvertently during the winter. An encroaching reedbed had been sprayed over two summers to kill it, before the pool was rescraped. Newly worked sections of wetland often turned out to be particularly productive, but nesting stilts were an extraordinary bonus. Now there was an island of soft mud with young shoots of glaucous bulrush *Schoenoplectus tabernaemontani* and sea club-rush *Scirpus maritimus*, in addition to old cut reed stems, and with a redundant gate-post lying across it.

Nest-building itself did not mean a great deal, as birds will scrape, toss bits of material about and may also build a nest without using it. Mating was also observed on the 19th, by which time the birds were becoming a reserve fixture, though the arrival in the dunes of the first of several bluethroats, after easterly winds, brought fresh numbers of visitors and other duties for the Warden and his summer assistant — who had only started at Holme the previous week.

On the 20th, the male flew up at a jackdaw and a common gull flying over the island, and by 21st May the stilts' behaviour had changed. No longer feeding together on Christie's Pool, and mating frequently, the female now fed for much of the time on Christie's while the male stood on the island in the Hun Pool, apparently on guard. When, at 4.00 p.m., he again flew up at a passing black-headed gull, the female's urgency to feed fell into context. Producing eggs requires considerable nutritional input. During late afternoon, the female was sitting in a scrape, pushing material around with her legs. The male moved pieces of old reed-stem with his bill. After 25 minutes of this activity, the female left the pool while the male remained at the nest. It is believed that the first egg was laid that evening. On the following day, the male continued his vigil at the island, chasing carrion crow, jackdaw, coot and lapwing, and feeding very little. Observation time was now at a premium with another May weekend, no shortage of birders in Norfolk, and more bluethroats on the reserve. It was then we realised, with a mixture of hope, dread and relief that black-winged stilts were going to breed at Holme. On the 23rd, the male was incubating, or simply covering the eggs, for much of the time before the first change over at the nest was observed.

The dates of production of the first and subsequent eggs are not known, and it is difficult to work them out. Each egg takes 1-2 days to produce and, as scraping was observed on the 21st, there would be difficulty in laying three eggs before the 24th. Neither stilts nor avocets are thought to incubate an incomplete clutch, though eggs may be covered in bad weather. With the intention of trying to see the contents of the nest, I crept to the top of the pool's bank and looked down onto the island, early on the 24th. The female, however, sat tight. Unwilling to risk further disturbance during the early stages of incubation, I withdrew.

However, from this point, the hide overlooking the island was not left unattended, and Bill Rutherford carried out the first night-watch, noting the birds calling in the dark at 2.10 a.m. and a changeover at 3.30 a.m. The relieved female flew off, returning at 4.45 a.m. before another changeover, with no obvious display, occurred ten minutes later. A routine had become established that was to continue, closely observed, for over three weeks.

While local birders and friends were sought to help with protection, three additional 'stilt-wardens' were hired during the following week to fill out the long hours and days that this clutch would remain vulnerable to egg-collectors. More radios were bought and borrowed. The stilts were already attracting sufficient revenue to pay for their protection, and there is no substitute for sufficient manpower and equipment. During the 24 hour watches, a log was kept of the birds' incubation

times, behaviour and events, from which the following account has been abstracted.

Since the stilts are colonial over most of their range, it should not be unexpected if some aspects of this solitary pair's behaviour should differ from that quoted in the literature.

Incubation: Three eggs were laid though four are more frequently produced. They resembled lapwing or avocet eggs, but less obviously pear-shaped. The nest was on bare wet mud, about 25cm across, built of reed stems, and situated 1-1.5 metres from the water's edge. Both birds incubated through the day in short periods, typically 40-70 minutes, but sometimes for as little as 30 or as much as 100 minutes. However, it emerged that the male usually sat for long periods of up to five hours from early evening until nightfall when, often after dark, the female would arrive to incubate for a similar period until 3.00 a.m. to 4.00 a.m. The hours usually passed without incident and the main activities were nest-duty changeovers and mobbing of real and imagined predators. Both birds sat for roughly equal lengths of time during the day. Changeovers were usually brief, between 25 and 60 seconds. The off-duty bird would fly in from its feeding area, landing some metres from the nest before walking up to the sitting bird, usually calling softly twice. A harsher call was very occasionally returned. Rarely, the sitting bird would not leave the nest despite its partner's calling, once including a harsh churr. Equally, after a long spell of incubation the sitting bird could appear anxious to leave the nest, even walking off before being approached. Occasionally, the incoming bird would fly directly to the nest, hovering and 'paddling' the air with its feet in front of its partner. The male was frequently seen tossing pieces of reed-stem in and around the nest and usually at changeovers, but the female only did this once. An interesting aspect of behaviour, not mentioned in *The Birds of the Western Palearctic*, was the shaking of mud and water from their feet immediately before settling on the eggs. This was noted at changeovers and also as the sitting bird returned to the nest after chasing a predator. If the purpose of this behaviour was to keep the eggs clean it was not totally successful as they were found to be already muddy in the first few days.

The incoming bird would arrive from any direction, but usually from the east, where they would feed on the invertebrate-rich wader pools. However, the off-duty bird rarely fed for any length of time on the Hun Pool where the nest was situated and usually flew off in 2-4 minutes. This time was spent within 10 metres of the nest, preening and feeding. On only one occasion during incubation did both birds feed together near the nest for a minute. Avoiding activity on the nesting pool could be to conserve food supplies or to avoid drawing attention to the whereabouts of the nest. As the off-duty bird was usually out of sight, it was not known what proportion of the time was spent sleeping, preening and feeding as manpower was concentrated on the Hun Pool. Although the off-duty bird was usually some distance away and behind banks, when the sitting bird flew up to mob a predator it was sometimes joined by its mate, and this could lead to a changeover taking place.

On the nest, the eggs were turned once or twice every 'session' or roughly every half-hour when it was noted. Preening on the nest was observed occasionally, but this usually took place off the nest, using indirect scratching. Either bird, when incubating, would occasionally leave the nest for no apparent reason. These unprovoked halts in incubation never exceeded five minutes of walking about or feeding, the bird remaining close by, but the nest was deserted on several occasions for up to seven minutes while stubborn herons or gulls were chased away. Essential management by reserve staff once kept the birds off the eggs for 19 minutes although again they remained close by.

Predator Response and Interspecific Aggression: One of the main activities, as mentioned, involved response to predators. To most observers, the stilts appeared to be both more aggressive and more territorial than avocets at all stages. Attacks on predators took place very frequently. The most aggressive response was, understandably, against heron, marsh harrier, kestrel, lesser black-backed gull and carrion crow, which were often pursued far beyond the pool by the sitting bird which would fly at the intruder calling loudly. Other gulls, cuckoo, magpie and jackdaw were also attacked vigorously, often in company with the lapwings which had a nest within a few metres of the stilts'. Curiously, a heron on the pool would be tolerated when 50 metres from the nest until another bird mobbed it, when the sitting stilt would join in with great persistence. Also, the odd magpie was observed unmolested on a nearby fence, though neither herons nor magpies in flight were tolerated. Other birds on the pool, shelduck, coot, mute swan, avocet and ruff were often harried for long periods especially by the incoming and outgoing off-duty bird which buzzed them with legs held down, in passing. The sitting bird, on the other hand, usually ignored them unless they ventured close to the nest when the stilt would sit with head bobbing uttering a reedy *klew* call. Another response was to sit with long neck erect uttering single warning *kik* notes. Farm-workers passing the end of the pool once elicited a 'lying-low' response where the head and neck were stretched out on the ground while the bird remained silent on the nest. One species, a common sandpiper, was ignored when very close to the nest, and no aggression was shown towards a mallard brood at first.

Fiercest disputes involved the stilts and redshanks, two pairs of which had brought their chicks down to the Hun Pool. These disputes seemed to provoke the stilts so much that all the other species received constant harassment on some days as well. This was particularly noticeable in the last week of incubation, when the stilts appeared to become more territorial, although increased numbers of gull and wader chicks around the pool at this time could have been the cause. A threat posture was occasionally observed, the stilt arching its wings towards the intruder.

On 9th June (6 days from hatching), the off-duty female stilt struck and knocked down a week-old redshank chick. Some time later the sitting male had left the nest to chase redshank when another redshank approached the nest. The stilt flew at the redshank with legs dangling, was seized around one leg by the redshank, and hovered with the 'shank dangling from one leg. This was repeated before the stilt turned its attention to a heron, later returning to the nest with a slight limp. The female was also seen to limp for a few hours after scuffles with over-flying gulls. Two days before hatching, the male seized a redshank chick by the neck and held it under water before several adult redshanks intervened and escorted the chick to safety. Yet on other occasions there was no reaction to redshank within a metre of the nest and the stilts could be quite relaxed when farm or reserve workers were operating near the pool. The sitting bird would leave the nest to investigate lapwing and redshank alarm calls given by birds on the grazing marsh and out of site from the nest.

Feeding: As mentioned earlier, the off-duty bird was generally thought to feed on the other pools which are rich in invertebrates by summer, but had been less productive in May when the stilts arrived. Rarely, the female was seen flying out into Ragged Marsh (a saltmarsh) and on another occasion flying back from the beach or another area of saltmarsh. Most observers found it difficult to judge whether attempts to catch invertebrate prey were successful or not, but one watcher recorded 12-15 prey items taken per minute with about 50% of stabs successful.

Although invertebrates along with common toad tadpoles in the early days were

thought to form the majority of prey the occasional three-spined stickleback of 15-20mm length was taken. Alternative methods of feeding were observed apart from stabs beneath the water surface. The male running to pick small 'flies' off the water, and the male flying with legs trailing, catching flies in the air. They were also seen to shallowly probe bare mud. There was no time to take invertebrate samples from the water, and the disturbance would have been unwelcome, but larger common invertebrates in the water layer included water boatmen *Notonecta*. On only 7 occasions did the off-duty bird feed on the nesting pool for more than a few minutes, and then for only 25 minutes on 2nd June; 36, 10, 10 and 8 minutes on 7th June; and 14 and 11 minutes on 9th June.

Hatching: Early on the 15th June the female was just touching the eggs rather than always turning them and was seen listening, stretching her neck and generally fidgetting. She could probably hear the young inside the eggs. At the next changeover she did not leave the pool. Incubation proceeded as usual until 6.40 p.m. after which the female constantly paid attention to the eggs. At 7.20 p.m. something was seen moving and this was confirmed when the male appeared at 8.20 p.m. and removed the eggshell, dropping it 20 metres away in the water. Just before 9.00 p.m. the chick, sandy with black bands and grey legs, was observed before being brooded through a cold, wet night.

By 6.20 a.m. on the 16th two chicks were visible, the second having hatched about two hours earlier and the third emerged at 8.16 a.m., the male on each occasion flying away to drop the eggshells in the water, in order not to draw the attention of potential predators to the newly-hatched chicks.

At 9.44 a.m., the two older chicks were out feeding, unsteady on their legs at first, before returning to be brooded. The adults frequently exchanged brooding duties, and for much of the time the two older chicks were out feeding while the third was brooded. It was not until 4.20 p.m. that the third chick properly emerged to feed for twenty minutes before returning to shelter under the male bird's wings as he crouched on his tarsi. As the three young came in to be brooded they were held under the wing with their legs dangling above the ground. Although it was cool and showers

were frequent, chicks up to a week old could be brooded very effectively. The weather was a greater threat when they were too large for easy brooding and too young to be waterproof. For the stilt-watchers the long hours of vigilance were passed and worries diminished. But for the stilts another phase was beginning.

As a round-the-clock watch was no longer kept, there was no longer a detailed log available. The following morning was sunny, but the longest period the chicks were out was 11 minutes and the majority of the time they spent brooded by one or other adult, who exchanged duties more frequently now. Feeding mainly took place within one metre of the island, with the prey they caught requiring visible effort for them to swallow. Like most waders, stilt chicks are not fed at all by their parents. The adults also called the chicks further out into the water, presumably to a better feeding area. During cool periods and in rain the young were brooded and were also sometimes called back for brooding.

The 18th brought 16.5mm of rain, poor conditions indeed for young wader chicks. Cool, wet, weather persisted to the end of the month. With careful brooding all three young survived until July when dry days with summer temperatures of up to 30°C arrived at last. The risk of death by exposure had receded.

Disputes between the adult black-winged stilts and other birds on the pools continued, if anything occurring more frequently than before. Redshanks and lapwings were intimidated, but oystercatchers and shelducks were unmoved by the stilts' attacks. The stilt family itself was not the subject of aggression by its neighbours and all the parent waders combined to keep bird predators away from the pool. Even on their first day, the stilt chicks crouched instinctively as a kestrel flew over.

After surviving the miserable June weather it was a blow when the smallest chick disappeared at 14 days old on the night of 30th June. It is thought that this chick was taken by a stoat. The following day the female was very agitated as she scolded an unseen predator on the bank of the pool near the 'stilt' hide. For a long time the adults did not let the other two chicks stray into this area, keeping them in the centre of the pool and the island. The two chicks remained closely associated throughout fledging and until they left.

By 11th July, the young were 25 days old and vigorously exercising their wings, although still only able to jump off the ground. Their juvenile feathers, mantle, scapulars, coverts and tertials were dull-brown edged golden-buff. Their legs were dull pink, the colour starting to change gradually from grey soon after hatching and at this stage were little longer than those of other waders. The tibio-tarsal ('knee') joint was remarkably wide. The bill, though long and slim, was also not yet fully developed. The overall impression of the juveniles was not unlike juvenile ruff. The overall impression of the juvenile vocabulary was much more limited than the adults' range of sharp calls only a quick coot-like one being noted and frequently mistaken for the latter species.

In the warm late fledging stage and with an abundance of prey, the chicks spent much of the day loafing and preening by the log which had formed the focus of so many of their days. By 9.00 a.m. they would often be sleeping, while one parent stayed close roosting/guarding and the other fed. By the 13th July (27 days old), both chicks could fly the length of the pool and after 31 days were competent fliers. A few days later they started to feed on other pools for the first time, and soon started using The Broadwater (a brackish lagoon) for feeding and roosting. This area is not generally used by waders other than avocets and redshanks at Holme though it contains abundant prey, particularly the amphipod *Corophium volutator.*

Throughout their stay the adults and young roosted together. A visitor saw one juvenile apparently preening the other on 30th July. Around this time the family

party, or one adult and two juveniles, thoroughly explored the immediate area, making excusions to Holme Marsh and particularly Titchwell's brackish areas.

On 14th August, the four birds were roosting together during the day as usual, and there was nothing to indicate that the adults would leave, presumably together, during the night. For another two weeks, the juveniles remained feeding, roosting, and taking the occasional flight to Titchwell together. With instinctive stilt aggression, one juvenile was observed chasing a ruff on the Hun Pool.

Accustomed to their visits to Titchwell I was not aware, as I watched them fly east at 4.00 p.m. on 31st August, that they were leaving Holme for the last time. The following dawn, the marshes adjoining the wader pools were noisy with gunfire at the opening of the wildfowling season. This may have frightened them off. The adults had stayed 89 days and the juveniles until they were 75 days old. This was not to be the last that was seen of them, as two juvenile stilts arrived at Belvide Reservoir (Staffordshire), the following day, a distance of about 200km (125 miles) just south of west. This would indicate that they had repeated the frequent navigational error of young birds that fly at a bearing 90°W of the intended direction of dispersal; south for the stilts. They remained at Belvide until 7th when they departed heading south. By one of the strange coincidences that occur in the birding world, the last person to see them in Britain was one of Holme's voluntary summer Wardens who was in his garden, south of Belvide, when the two stilts flew over at 2.00 p.m. on the 7th.

It is unlikely that they will return in 1988 as black-winged stilts are well-known as a dispersive species, occasionally breeding far north of their normal range, without establishing regular breeding colonies. There have been more breeding attempts in the Netherlands than any other country in Northern Europe, with nesting confirmed in 24 years between 1931 and 1976 including a record 39 pairs in 1965. However, it appears that breeding did not take place there in 1987. This is surprising in view of the number of vagrants in Britain during May. This was only the second occasion black-winged stilts have raised young in Britain, the first being on Nottingham sewage farm in 1945. Two other pairs failed that year and a further unsuccessful breeding attempt was made on the Nene Washes in 1983. Previously, the species had been recorded twice at Holme, while this occurrence made the thirty-first county record.

As the Warden fortunate in having breeding stilts on the reserve I manage, I would like to thank the visitors for being patient with the few restrictions we had to impose. Thanks are due to the RSPB Regional Office and Species Protection Dept for their assistance and most especially to the dedicated team of voluntary watchers who spent over 1,000 man-hours during incubation. Without them there would have been little to write about.

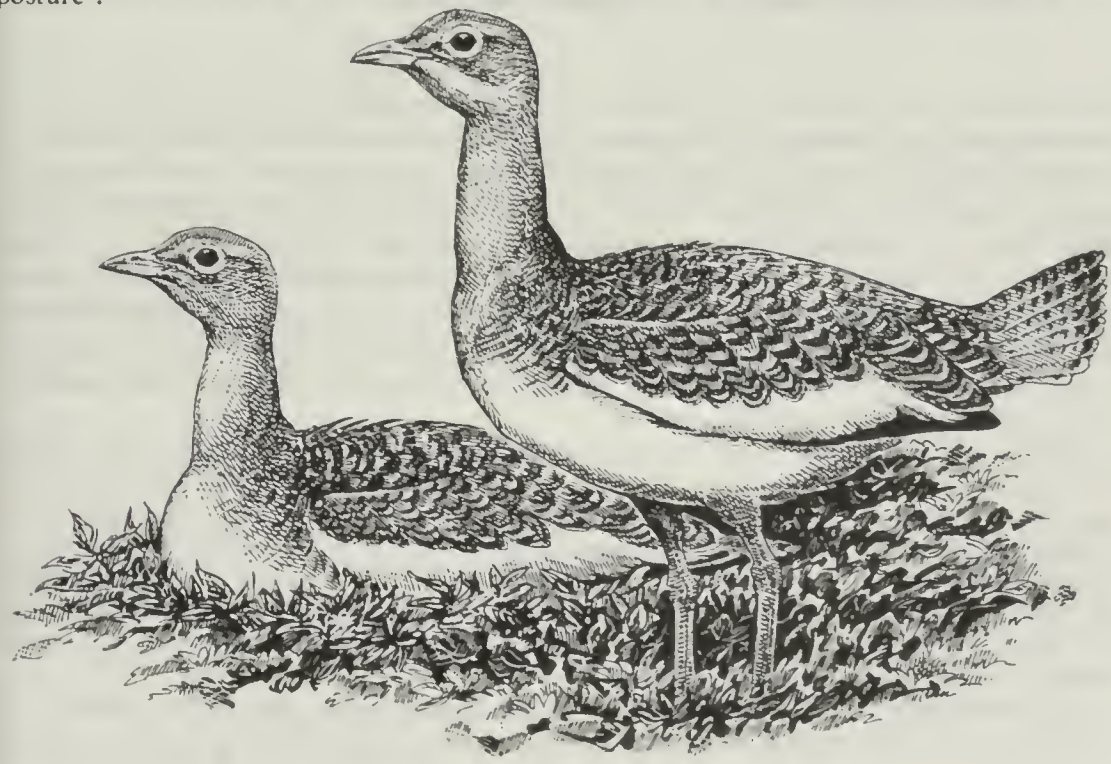
Great Bustards

D. A. Dorling

One of the early excitements of a vintage year in the County was the appearance of two Great Bustards at New Buckenham on the afternoon of 7th February. They were discovered by a local resident whilst out walking his dog not expecting to flush anything larger than a pheasant.

This is the first record for Norfolk of this endangered species for eight years when a single bird was seen and photographed at East Somerton and Winterton in February and two came in from the sea at Bacton on 2nd March 1979. The New Buckenham birds preferred a large field of oil-seed rape, but despite their large size they were elusive and at times difficult to locate. Remarkably well camouflaged on the ground, on take-off they were transformed into powerful fliers with startlingly white wings. They remained in the area until mid-day on 10th February and were not reported again. They were extremely wary, but many observers obtained good views and it was generally considered that both birds were immature males, lacking moustachial bristles.

The following description is by courtesy of *Twitching* magazine: 'Two extremely large and powerful turkey-like birds with long necks and long legs. Pale chin and throat merging into rich grey foreneck and upper breast. Much of face and head also grey-coloured, but rear of crown and hindneck brownish. Lower breast, belly, vent and under-tail coverts gleaming white. Upperparts, from base of neck across to foreflanks and back as far as tail tips a rich mixture of neat golden-brown, chestnut-brown and black barring. This barring becoming wider and more prominent on the coverts and especially so on the large tertials. Large area of secondaries gleaming white and neatly contrasted against black primaries. Stout pale grey bills and thick, long, greyish-green legs. One was perhaps a first-winter male; the other perhaps a second or third-winter male. Normal gait was a sedate walk with head and neck erect in an alert posture'.



The Norfolk birds were part of a small invasion of Great Bustards almost certainly displaced from their eastern Europe range by extremely severe weather. Suffolk had four from 16th January at Harkstead until 20th January and three spent nearly three weeks in the Kirton area until 7th February. On that day two were spotted flying north along the coast before turning inland at Kessingland — presumably to New Buckenham. Three other Great Bustards spent eleven days from 10th February at Theberton near Minsmere finally being seen at Sizewell on 22nd February. These were also considered to be immature males.

The influx was also witnessed in Holland during the 1986/87 winter, with a group of ten birds in Limburg and seven others in Flevopolders in January. These totals represent the highest numbers in Holland since the remarkable influx of over a hundred there during the 1978/79 winter. One was seen coming in from the sea at Ijmuiden in April 1987 — possibly an East Anglian bird returning eastwards.

Red-rumped Swallows in Norfolk

As I was scanning the gulls and waders on Pat's Pool at Cley at 8 a.m. on 8th April a hirundine with a white rump flew across my field of view. Having then seen only a single House Martin for the year I decided to have a good look at it with binoculars. To my amazement I found the bird to be a Red-rumped Swallow. It was over the far side of the pool hawking for insects and looked like staying more than the usual few minutes of hirundines at this time of the year. I rushed to the nearest telephone to spread the news. Within an hour some 40 birders were present, the first long-distance ones arriving within two hours of the bird being found. It made off over West Bank at 9.30 a.m., but was soon re-located flying round Watcher's Cottage before perching on telephone wires nearby.

Main features included the pinkish washed white rump and face, neck and underparts. Flight was more like a House Martin than a Swallow. Overhead the wings appeared blunt tipped and rather broad based making it appear short-winged. The tail streamers were thicker than in a Swallow and again blunt-tipped, with the streamers appearing to curve inwards. Perching on overhead wires more detail was observed and on the breast fine streaking could be discerned. The head was mostly a rufous-buff with paler face and throat. The cap was a metallic dark blue. Upperparts and wings were the same shade of blue as the cap and there were whitish markings on the mantle.

This red-rumped swallow disappeared in the late morning, but in the evening was re-located over Cley village near the George and Dragon Hotel. It caused a traffic

jam and some amusement and curiosity among the locals. It was watched until dusk when it flew off towards the marshes to roost. Next day it was performing in front of the Warden's house from 6.20 a.m. Most of the time was spent hawking insects over the Glaven marshes on the west side of the village following early morning feeding flights with other hirundines around Watcher's Cottage. Each morning it also perched on telephone wires outside the house to preen and sing. It was absent from its usual dawn site on the fourth day of its stay, but was soon found feeding with a few Swallows along the Glaven near Wiveton Stone Bridge. Here it performed well to the appreciative birders, sweeping low and at times coming quite close. In the late afternoon followng a heavy shower the Red-rump was seen to fly into the porch of Cley Church. Here it stayed until the following morning at 6.30 a.m. providing observers with views down to a few feet. Final views were obtained of this splendid vagrant from the south up to 9 a.m. on 12th April. The weather, again cold and wet, doubtless persuading it to seek better feeding elsewhere.

E. T. Myers

November 12th dawned bright and sunny with a strong westerly wind. Hardly the best of days for bird-watching. Consequently I made a late start for Winterton not arriving until 9.30. Firstly, I checked the small paddock and rough field by the village. This proved fruitless with no sign of the Red-backed Shrike present there a few days previously. I then headed north towards the dunes.

Soon I spotted 4 Skylarks coming in from the direction of the sea. As they approached I noticed a lone swallow flying low with them. As it banked low over the marrams I was very surprised to note that it displayed rusty shading on the rump and a similar coloured collar at the nape of the neck. Red-rumped swallow, a bird I have seen on three previous occasions in this country and also in Spain, Morocco, Israel and Egypt. I could hardly believe my eyes as it passed me at not more than 5 metres distance. This enabled me to obtain a detailed description. Main features included an all-black mantle, tail and under-tail coverts, paler wings and a dark cap. Underparts were off-white or very pale sandy-buff (lacking any pectoral band), the rump becoming paler until it was almost white towards the tail. The bird headed inland over the nearby wood still accompanying the larks. I continued walking north towards the toad pools where 2 Jack Snipe flew up at my feet.

Suddenly, from the Horsey direction, I spotted 2 hirundines approaching. As they swept in to the lee of the wood I realised both displayed the distinctive features of the Red-rumped swallow. I watched fascinated as they leisurely hawked insects, gliding on outstretched wings in the manner of House Martins, before moving off to the south towards Winterton Church.

The Red-rumped Swallow is typically a bird of wild places including mountains and sea-cliffs offering protective caverns for breeding in southern Europe. A summer migrant, it returns to Spain and Portugal in March and April. A total of over 50 Red-rumped Swallows was reported in this country after performing a remarkable and unprecedented reverse migration towards the end of October. In addition 13 were reported in the spring.

The first Norfolk Red-rumped Swallow occurrence was between 6th and 25th March 1952 when one frequented Blakeney Quay and the Glaven water-meadows. It was the first of many rarities filmed in colour by the late Dick Bagnall-Oakeley. Subsequently single birds have been identified in the county at Mundesley (1968), Cley (1977 and 1980) and Holme (1979).

B. W. Jarvis

Penduline Tit: New to Norfolk

S. J. M. Gantlett

A singing Penduline Tit was found at Hickling Broad on 4th April 1987 by one lucky observer, David Hewitt. Thirty or so birders were soon on the scene, but there were no further sightings that day. It was cold and windy — hardly ideal conditions for finding a tiny marsh bird in one of the country's most extensive reedbeds.

Early next day conditions had improved, but it was late morning before the prize was relocated at least half a mile from the original site. During that afternoon over a hundred birders were able to enjoy watching Norfolk's first (and Britain's twelfth) Penduline Tit. It remained in the area until at least 10th April, but throughout its stay it remained elusive and many observers went away disappointed.

Hickling Broad is a National Nature Reserve of over 1,300 acres. The very nature of its habitats: extensive reed-marsh, carr and open water, makes access very dif-

Black-tailed Godwits arriving at Titchwell at dawn during spring high tide. Increasing numbers of Avocets have bred annually at Cley since 1977.

A Marsh Sandpiper provided red-letter days at Cley during early autumn migration. Following the mid-October hurricane this Grey Phalarope was filmed at Hockwold.

Black-winged Stilt studies taken at Holme where a pair reared two young. These elegant waders have only bred successfully in this country on a single previous occasion.

Hunstanton cliff ledges held over sixty young Fulmars in August. At Scolt Head 2,900 pairs of Sandwich Terns reared 3,200 young to the flying stage.

ficult. Fortunately for bird-watchers the Penduline Tit chose to frequent the south edge of the Broad where access and viewing along Weaver's Way is by way of a raised bank public footpath. This Penduline Tit was an adult male and was frequently heard calling and performing its brief and subdued twittering song. It was extremely active appearing almost anywhere along the south side of the Broad. It was frequently observed feeding on seed-heads of lesser reedmace, the drifting white downy plumes on the breeze revealing to more than one observer the bird's presence. This enchanting vagrant also spent much time moving around scattered clumps of willows in the marsh, constantly jerking its tail from side to side in characteristic fashion.

It was a tiny bird, about the size and shape of a Blue Tit. The general effect was suggestive of a diminutive and pale male Red-backed Shrike. *Twitching* magazine has provided the following description: 'Head pale grey with a broad black mask widening from the forehead through and behind the dark eye. Bill dark, fine and pointed. Mantle and wing-coverts rich dark chestnut. Wings and tail dark grey extensively edged pale greyish-white especially on tertials. Underparts pale pinkish-buff, whiter on chin and throat. Legs and feet blackish. The call: a high-pitched plaintive *tsee*'.

The first British record was at Spurn in 1966 followed by occurrences in Scilly, Kent (1980 and 1983/4), Gwynedd, Humberside (2 together), Essex and Northants. At first sight it might appear that a Penduline is an unlikely species to occur in Britain. But there is considerable evidence of a northerly and westerly spread within Europe. It is also a bird which wanders in winter and at times (like Bearded Tits) exhibits eruptive behaviour. Despite its tiny size it is capable of travelling considerable distances — up to 500 miles. As an example of rapid range expansion, the first and very characteristic 'cock's nest' was found in Holland in 1962 (the bird itself was never actually seen). Within two decades observations in that country had become so widespread that the species was removed from Dutch Rarities Reports.

Slender-billed Gulls: New to Norfolk

Paul Varney

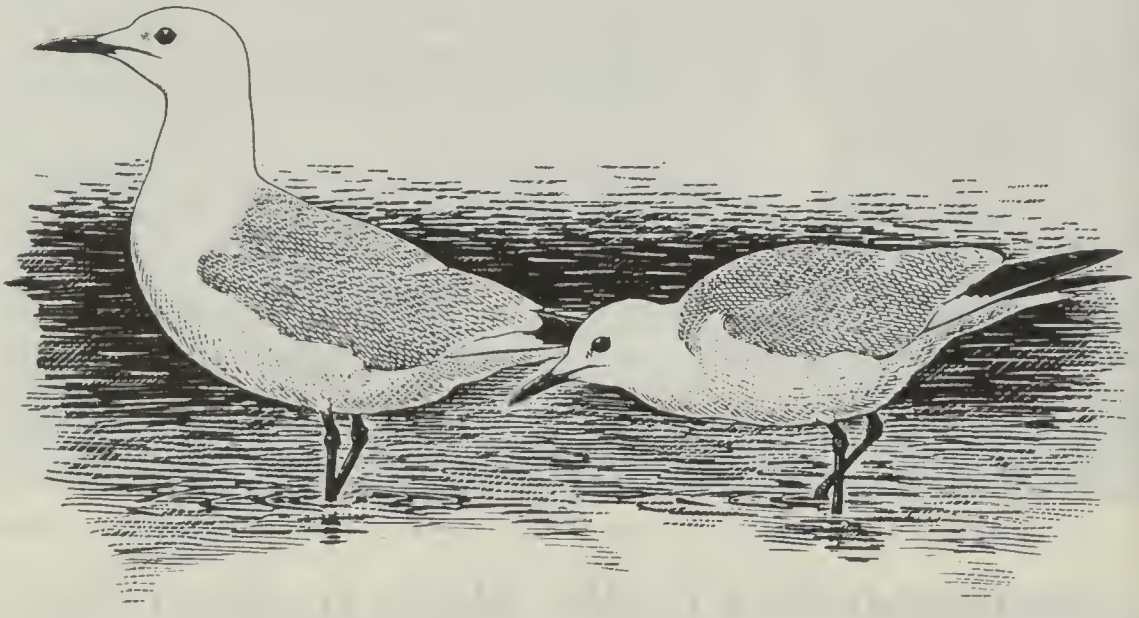
May the 12th 1987 began as a normal working day until a late afternoon visit to Snettisham to see a Hoopoe. Having enjoyed excellent views of this bird as it flopped along on rounded black and white wings looking like a large moth, I was on the return journey when given the news of two Slender-billed Gulls at Cley, a new bird for the County. On arrival there I joined the throng at the North Hide as light began to fade, but was able to enjoy views of these easily identifiable gulls through the might Questar telescope of Bryan Bland.

The birds were found by Martin Gilbert, from Runcorn who was visiting Cley to see a Wilson's Phalarope, and scanning the pools from Teal Hide. He was able to watch the southern wanderers as they fed 'ankle' deep in water, pecking food delicately from the surface, before they took wing and flew to the North Pool. In flight they revealed long pale wings and a noticeable contrast between sharp red bill and clean white head.

They were both adults, one about the size of a Black-headed Gull with the other appreciably (about 15%) larger. The most striking feature was the amazingly clean white head, neck and breast, the head being long and pointed. The bill was long and fairly weighty and in poor evening light looked black, contrasting markedly with the white plumage. The mantle was very pale grey, paler than a Black-headed, with a

similar wing pattern on the perched bird. The eyes appeared small. They remained in the same area until dark.

The following dawn the birds were eventually located in a slightly different area of the marsh, giving excellent views in the improved light and showing additional features not visible the previous evening. The larger bird was much smarter with a very noticeable rose-pink flush on the breast and belly, whilst the other bird showed less bright pink. Bills were bright red as were the eye rings and legs. The birds were displaying to each other, confirming that they were a pair — the larger bird being the male. When displaying the male stretched its neck which was very long: a characteristic of the species.



The birds stayed in the area three days and thanks to the considerable efforts and understanding of Bernard Bishop and David Abdullah, the warden and his assistant at Cley, were seen by a large number of Bird Watchers. Throughout the stay the male remained very protective towards the female, frequently positioning himself between her and other gulls and often chasing them away. They were also seen to copulate on numerous occasions, leading to hopes that they would settle down to breed. On the last evening of their stay they were watched until dark from the Richard Richardson Hide, having earlier flown in from Blakeney Harbour. They were not seen again, to the great chagrin of the weekend birders.

There are only three previous accepted British records: first-summer birds in Sussex in June and July 1960 and again in April 1963 and a 'pink' adult which appeared in Kent on several dates between July and September in 1971 with presumably the same bird at Minsmere on 15th August that year.

The species has an irregular disjointed breeding distribution from Southern Spain and France, eastwards to the Black Sea. Presumably the pair of Slender-billed Gulls were part of the same displacement of Mediterranean birds which brought the Black-winged Stilts to Holme.

Lapwing Breeding Survey

Moss Taylor

During April 1987 the British Trust for Ornithology organised a survey of the breeding Lapwings in England & Wales. One randomly selected tetrad in each 10km square was covered and so no absolute figures for the number of breeding pairs was obtained. However, the habitats used by the breeding birds was recorded and the results help to explain why there has been a decline in numbers, particularly in southern and eastern England.

In Norfolk, the major habitat types occupied by breeding pairs were as follows: spring sown cereals 20%, tilled bare ground 20%, autumn sown cereals 15%, permanent grass 15%, sugar beet 9%, ploughed bare land 6% and other spring crops 6%.

Many Lapwings will nest in one habitat, such as spring cereals and move the newly hatched young to another, such as water meadows. A point made by one observer — "All four pairs in one group, the common factor being fairly stony ground with a southerly to westerly aspect and a stream with marshy ground within the chicks walking distance."

Unfortunately both these habitat types are becoming scarcer through changes in agricultural practice. In recent years the trend has been to drain damp areas and to change from spring sown to autumn sown cereals. Autumn sowing results in a crop that has already grown too tall by April for nesting Lapwings, also the use of fertilizers encourages a denser crop with an absence of thinner patches and bare ground. The preference for spring sown cereals and tilled bare ground is clearly shown in the results of the survey, 40% of the breeding pairs being found in one or other of these habitats. Another observer commented — "A few pairs of Lapwings nest each year, shifting their breeding sites according to the areas of suitable nesting habitat available to them each season. They generally choose nesting sites where the vegetation is very short or patchy with areas of bare ground. Tilled bare land is preferred to fields with deep furrows. Pea fields are also favoured when only a few inches high."

Additional problems faced during incubation relate to the more frequent use of machinery and increased stocking rates, both of which result in damage to nests. Although this does not necessarily mean no young are reared as one observer remarked — "The tractor drivers reported that some nests get destroyed each year, but they fully expected the birds would start nesting again, which was confirmed when I returned on a later date." In addition the availability of food for the fledglings is reduced by pesticides and herbicides.

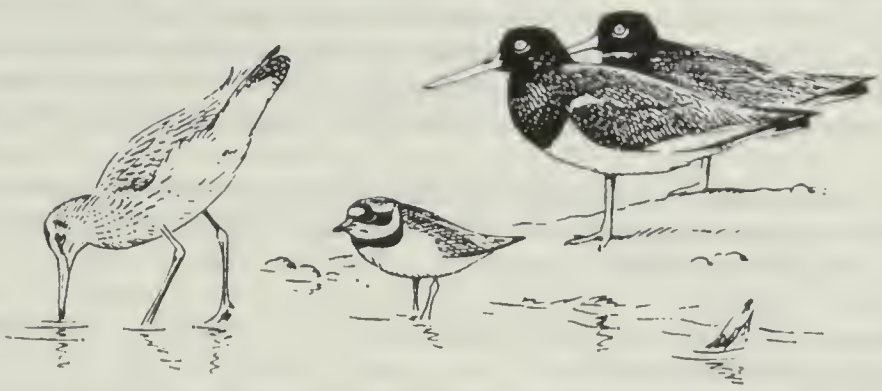
Finally the tendancy to replace hay with silage affects all stages of the breeding cycle — the application of extra fertilizer resulting in grass which is too tall and too thick in which to nest and in those areas where breeding is possible the first cut in May destroys many nests and young.

However, factors other than loss of habitat are clearly involved as suggested by the comments of two other observers — "Despite searching for four and a half hours, not a single Lapwing was found despite plenty of varied suitable habitat (autumn & spring sown cereals, bare tilth and planted potato ridges)," and "One large field of untilled land which looked very suitable held no Lapwings at all."

Finally the pointed note of one observer — "I fear Lapwings will not survive long on my patch. Most of the permanent pasture has gone to cereal in the last two years. The little remaining will be lost as soon as the dairy herd has been sold."

The Wash — Mecca for Waders

Rowena Langston



The Wash is an internationally important estuary for wading birds and ranks second only to the Wadden Sea/Wattenmeer in western Europe in terms of peak numbers of waders present. The Wash Wader Ringing Group has been studying the different wader populations for over 20 years and has caught over 175,000 birds. This long-term research has helped to clarify the relative importance of the Wash to different species of waders which use the estuary for:—

i) a staging post during migrations in autumn and, to a lesser extent, in spring;
ii) a moulting site, second only to the Wadden Sea in western Europe, in terms of total numbers of waders, and
iii) a winter area.

*Peak Winter counts of waders at the Wash**

Species	*Peak count 1986/87*	*Month of peak count 1986/87*	*Average peak count over 5 yrs. (82/83 - 86/87*
Oystercatcher	*23,202*	*February*	*24,999*
Grey Plover	*5,512*	*February*	*4,191*
Knot	*83,340*	*February*	*88,102*
Sanderling	*768*	*January*	*469*
Dunlin	*37,257*	*February*	*34,525*
Bar-tailed Godwit	*12,809*	*January*	*8,593*
Curlew	*2,265*	*February*	*3,691*
Redshank	*3,346*	*December*	*3,906*
Turnstone	*754*	*February*	*841*

**Birds of Estuaries Enquiry* counts, courtesy of the British Trust for Ornithology.

Oystercatcher: Most Oystercatchers using the Wash are from breeding grounds along the west coast of Norway; 80% of breeding season recoveries of ringed Oystercatchers have been from there. Oystercatchers arrive at the Wash from breeding areas in late July/early August. Most moult at the Wash and then remain there during the winter, but there is also some onward migration, following completion of moult, north along the east coast of England and south to the south coast of England and north coast of France. At least some of the latter may indicate changes in wintering area, but most are thought to return to the Wash in subsequent winters.

Interchange between shores of the Wash, by Oystercatchers is common in autumn, but winter movements appear to be more localised.

Ringed Plover: The Wash serves, principally, as an autumn refuelling stop for passage-migrant Ringed Plovers on their way from breeding grounds in Greenland/Iceland and northern Scandinavia/western Siberia to wintering sites in Africa. Some continental breeders may also pause at the Wash during migration to wintering areas in western Britain. Peak passage numbers of Ringed Plovers occur at the Wash during August/September. Thereafter, numbers of wintering birds are low.

Spring passage is at a considerably reduced level, compared with autumn passage, since the main migration route for the Greenland/Iceland breeding population is along the west coast of Britain.

Grey Plover: The Wash has the highest numbers of wintering and passage Grey Plovers of any British estuary.

Two Siberian breeding populations of Grey Plovers have been identified at the Wash: one moults and most birds overwinter at the Wash, with some moving on to other estuaries in southeast and southwest England after completion of moult. The other population pauses only to refuel on the way to moulting and wintering areas in southern Europe and Africa.

Winter influxes of Grey Plovers, which moult at the Wadden Sea, occur to varying degrees from year to year, particularly in cold winters.

Spring passage at the Wash is less pronounced as the return migration is staggered.

Knot: The Wash supports over a quarter of the estimated wintering numbers of Knot in western Europe, which are considered to be of nearctic origin, breeding in Greenland and northeast Canada. Most of these birds migrate via Iceland, but recent findings show that at least part of the population migrates regularly, in spring, via northern Norway.

The main influx of Knot to the Wash is in August. Some birds moult at the Wash and remain there for the winter, whilst others moult there but then move on. This post-moult dispersal is westwards to the Dee, Ribble and Morecambe Bay estuaries; northeast to the Tees and Tyne estuaries and the Firth of Forth; and south to the Thames. There are also influxes to the Wash of Knot which moult at the Wadden Sea.

Knot from Siberian breeding grounds also occur at the Wash in some autumns, on migration to south and west Africa.

Knot are higly mobile within the Wash in all seasons.

Sanderling: Two populations of Sanderlings have been identified at the Wash, which may represent nearctic and Siberian breeders; there is evidence that both occur at the Wash. One group refuels at the Wash in autumn on its way south whilst the other group moults at the Wash before overwintering there or moving on to sites along the east coast of England, such as Teesside, or to southwest England, with a few movements to southeast England also noted. Following the large scale of autumn passage, the wintering population is relatively small.

Sanderlings are very consistent in returning to the Wash each year, as shown by frequent recaptures of Wash-ringed birds (one bird has been caught 13 times in 12 years).

Spring migration is on a smaller scale than autumn migration, partly because it is staggered over a longer period, but also because most nearctic birds migrate up the west coast of Britain.

Dunlin: Most Dunlin occurring at the Wash are of the race *alpina* from breeding areas in northern Scandinavia and northwest Russia. Adults arrive at the Wash in late July/early August, after migrating via the Baltic coast. Most moult at the Wash before some move on in October and November, mainly to estuaries in western Britain and Ireland, but also south through France to Morocco. Juvenile Dunlin arrive at the Wash about one month after the adults but then adopt a similar pattern of dispersal. Also, a proportion of juveniles overwinter at the Wash.

Post-moult influxes occur from the Wadden Sea, particularly in cold winters.

Spring migration through the Wash is substantial in March and April.

Ringing recoveries show pronounced site fidelity of Dunlin, both between and within winters.

The high turnover of Dunlin through the Wash in autumn includes *schinzii* Dunlin, probably from Iceland. These birds refuel at the Wash from mid-June to mid-August on their way to moulting and wintering sites in northwest Africa. There is slight autumn passage of *arctica* Dunlin, which breed in northeast Greenland, through the Wash in August.

Curlew: Most Curlews arriving at the Wash in autumn are considered to have come from Finland and neighbouring countries. Counts from the *Birds of Estuaries Enquiry* indicate fewer wintering birds at the Wash than in autumn. This may be due to movements inland or dispersal from the area as indicated by one dye-marked Curlew which was seen on Jersey later in the same winter.

Bar-tailed Godwit: Ringing results indicate that Bar-tailed Godwits visiting the Wash come from Siberian breeding grounds. Most adult Bar-tailed Godwits arrive at the Wash in August and most are considered to moult there. Juveniles arrive in September. Decreased winter counts from the *Birds of Estuaries Enquiry* and two ringing recoveries indicate some post-moult migration southwards to wintering areas in southern Europe and northwest Africa.

Redshank: Two breeding populations are represented at the Wash; a mainly British population from eastern Britain, and Icelandic breeders. Both groups moult at the Wash before many disperse west and south as far as Iberia. There is little evidence for spring passage through the Wash. Those Redshanks which remain at the Wash appear to be sedentary.

Turnstone: Two breeding populations occur at the Wash. Turnstones from Greenland and Ellesmere Island in northeast Canada moult and winter at the Wash, whilst Turnstones from Finland pause at the Wash to refuel in autumn en route to moulting and wintering sites in west Africa. There is little evidence for return passage through the Wash in spring by the northern European birds.

Turnstones at the Wash are very site-faithful within and between years.

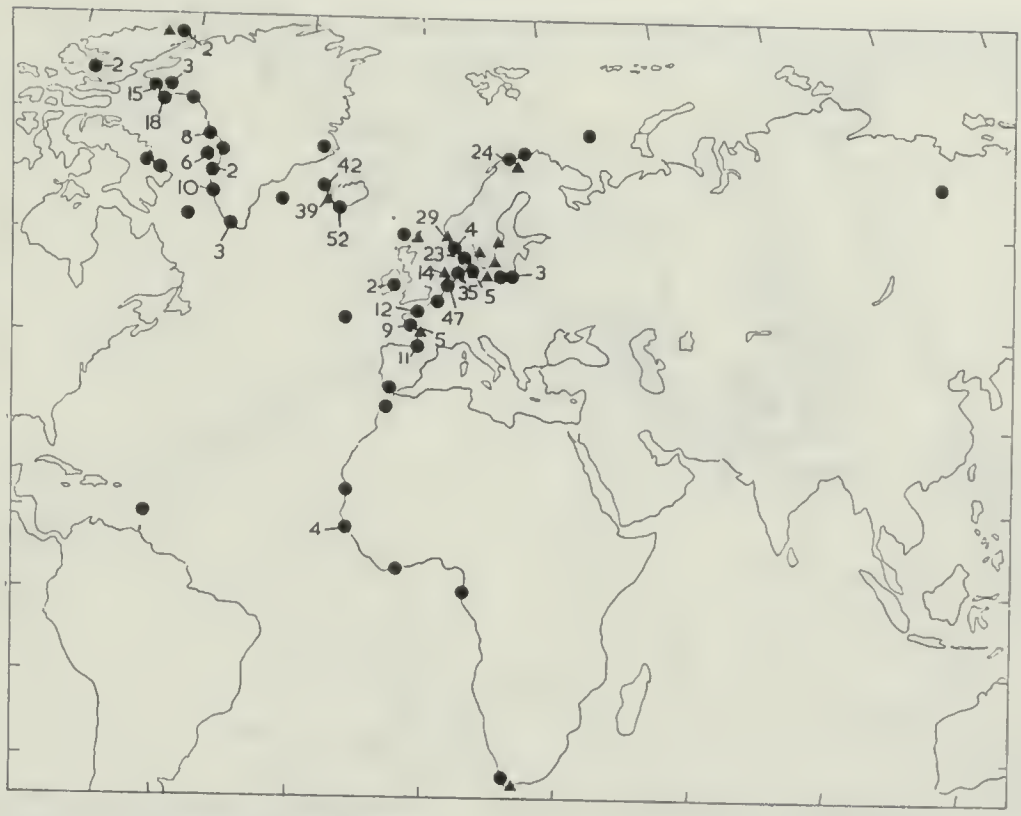
Further reading: Wash Wader Ringing Group report 1985-1986. (Available from Mr. P. Ireland, 27 Hainfield Drive, Solihull, West Midland at £1 each.)

The following recovery maps show movements of waders to (▲) and from (•) The Wash.

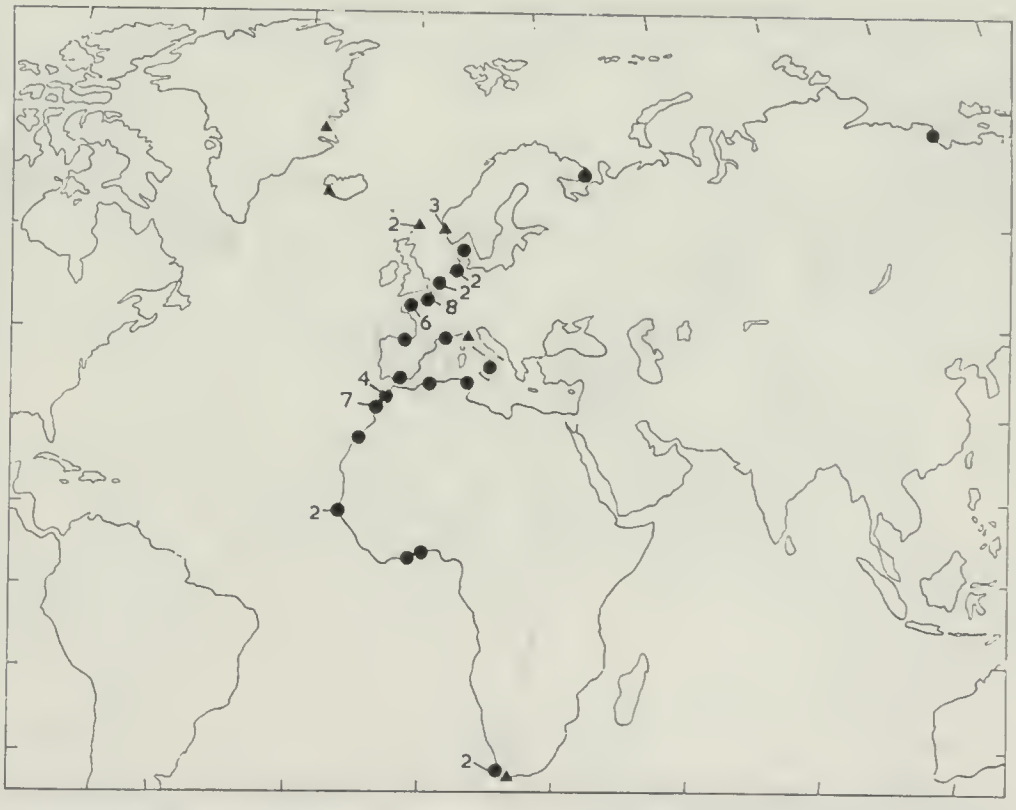
OYSTERCATCHER: Overseas movements to/ from the Wash

RINGED PLOVER:
Overseas movements to/from the Wash

GREY PLOVER:
All known movements to/from the Wash



KNOT: Overseas movements to/from the Wash

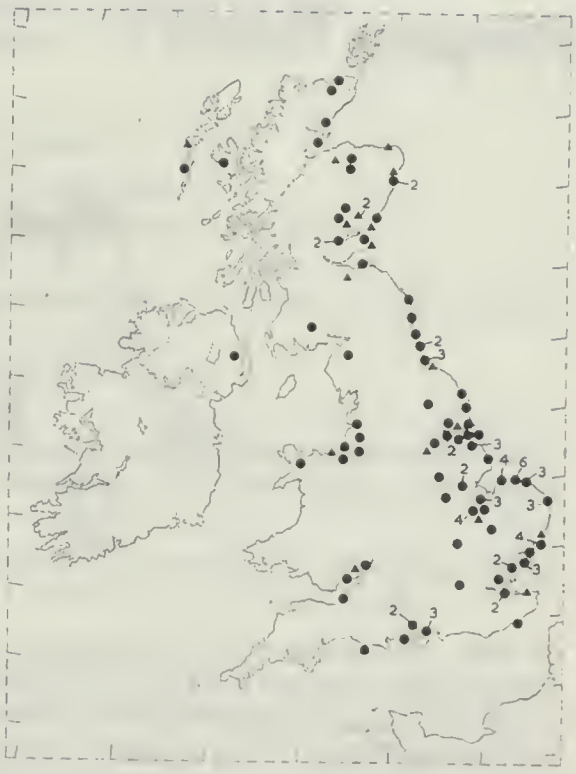


SANDERLING: Overseas movements to/from the Wash

CURLEW: All known movements to/from the Wash

BAR-TAILED GODWIT:
All known movements to/from the Wash

REDSHANK: Overseas movements to/from the Wash



REDSHANK: UK movements to/from the Wash

TURNSTONE: All known movements to/from the Wash

Ringing Report

Moss Taylor

In 1987, over 16,000 birds were ringed in Norfolk, excluding those handled by the Wash Wader Ringing Group. This is probably more than in any previous year and is partly a reflection of the increased number of ringers operating within the county. Noteworthy species totals included 530 Black-headed Gull nestlings at Cantley and 1,550 Swallows, 1,360 Blackbirds, 1,130 *Acrocephalus* Warblers, 1,610 Blue Tits and 2,750 Greenfinches. Less common species ringed in 1987 included Honey Buzzard, Hobby, Red-breasted Flycatcher and Lapland Bunting.

Once again, it has not been easy selecting the recoveries for publication, so great has been the number from which to choose. As in previous years, the great value of colour marking is admirably demonstrated by the recoveries of Spoonbill, Bean and Brent Geese, while Montagu's Harrier and Purple Sandpiper are infrequently reported in the recovery section.

This report would not have been possible without the enthusiasm of all the ringers in Norfolk, nor the help with wader recoveries from Dr. N. Branson and details of colour-ringed Brent Geese from Bart Ebbinge. Ringers are reminded that the annual meeting of Norfolk ringers is held on the first Thursday of March at the Phoenix Hotel, Dereham at 7.30pm.

The explanation of abbreviations used in the recovery section has not been given for several years and is as follows:

1	pullus (nestling or chick).
2	fully grown, year of hatching unknown.
3	hatched during calender year of ringing.
3J	as 3, but showing some juvenile plumage when ringed.
4	hatched before calender year of ringing, exact year unknown.
5	hatched during previous calender year.
6	hatched before previous calender year, exact year unknown.
M	male.
F	female.
v	caught or trapped, released with ring.
vv	ring number read in field or sight record of identifiable colour ring(s).
x	found dead or killed by man.
xF	found freshly dead or dying.
?	manner of recovery unknown.

NORFOLK RECOVERIES NOTIFIED IN 1987

Fulmar:

1	4.8.84	Sheringham
x	1.1.85	Bawdsey, Suffolk 105km S

Spoonbill: Identified by a combination of colour rings.

1	12.6.87	Tweede Duintjes, Terschelling, Netherlands
vv	21.8.87	Cley 298km W

Mute Swan: Is it possible that this bird joined a party of Whooper Swans passing through Scotland en route from Iceland to Welney?

1M	29.8.82	East Fortune, Lothian, Scotland
vv	1.1.86	Welney 434km SSE

Bean Goose: Full details of the unique discovery of 22 neck-banded Bean Geese marked together in Swedish Lapland and wintering in the Yare valley, are given in the Classified Notes.

Canada Goose: A full account of the results from ringing the moulting Canada Geese in Holkham Park in the late 1970's is planned for a future NBR.

4	8.7.79	Holkham Hall
x	13.4.87	Kimberley, Wymondham 45km SSE

Barnacle Goose: It is generally assumed that Barnacle Geese appearing in Norfolk in winter, belong to the breeding population from Kolguev and Novaya Zemlaya which winter regularly in the Netherlands, whereas birds wintering in Donegal come from the Greenland population. This particular bird was apparently attracted to domestic animals and captive birds at Bessingham.

4	23.11.85	Seskinmore, Donegal, Ireland
v	15.4.86	Bessingham 669km ESE

Brent Goose: Sightings of colour-ringed Brent Geese in north Norfolk, included birds ringed at Salthouse in 1974 and a pair ringed together in The Netherlands in April 1986 and seen together again in The Netherlands in December 1986, at Weybourne in March 1987 and back in The Netherlands in May 1987.

Wigeon: More Wigeon are currently ringed at Pensthorpe than at any other site in Britain and many have been recovered in the breeding area in central and northern Russia. Observers are particularly asked to look out for any colour-ringed Wigeon, noting the ring colour and on which leg(s) the bird has been ringed. Any such sightings should be sent to the Wildfowl Trust, Slimbridge, Gloucester.

5M	17.3.84	Pensthorpe
xF	26.5.85	Berezovo, Khanty-Mansi, USSR 3,855km ENE

Tufted Duck: Only the fourth German-ringed Tufted Duck to be found in Britain.

1F	7.8.85	Altfriedland, Frankfurt, German DR
x	11.1.86	Rockland Broad 919km W

Montagu's Harrier: The first recovery of a British-ringed Montagu's Harrier since 1961, when three were recovered in France — all shot! At least this bird died of natural causes — the remains being found in the nest of an Eagle Owl.

1	28.7.85	West Norfolk
x	1.9.86	Rochelfort en Valdaine, Drome, France 965km SSE

Oystercatcher: This bird was not freshly dead when found after being hit by a train, but nevertheless had been ringed twenty years previously.

4	11.8.67	Snettisham
x	24.7.87	Amsterdam, Noord-Holland, Netherlands 305km E

Knot: Many Greenland Knot wintering at the Wash are known to return to Greenland via north Norway, as shown by the first recovery. But not many Russian-breeding birds are found there.

6	13.5.86	Kantornes, Troms, Norway
v	28.2.87	Snettisham 2,084km SSW
3	21.8.85	Reda Mouth, Gdansk, Poland
v	28.2.87	Snettisham 1,202km W

Purple Sandpiper: This recovery could possibly be an indication of the breeding area of some of our wintering Purple Sandpipers.

6	13.4.86	Nidingen, Halland, Sweden
vv	1.3.87	Heacham 874km SW

Dunlin: The first bird demonstrates the longevity of even small waders. While most Dunlin migrate along the 'Baltic flyway', some juveniles are known to come down the west coast of Norway as shown by the second. The remaining recoveries are examples of possibly typical westwards movement as winter progresses and birds wintering further south in subsequent years.

4	22.7.76	Ottenby, Oland, Sweden
x	25.1.87	Morston
3	4.9.86	Tjorveneset, Vest-Agder, Norway
v	28.2.87	Snettisham 698km SW
4	21.9.86	Terrington
v	28.2.87	Dundrum, Down, Northern Ireland 436km WNW
4	23.7.82	Terrington
xF	29.1.84	Moana, Pontevedra, Spain 1,352km SSW
4	1.9.81	Terrington
x	7.3.87	Cadiz, Spain 1,889km SSW

Curlew: This is a good age for a Curlew found in the normal breeding area for birds from the Wash.

6	6.5.73	Wolferton
?	1.6.87	Ornskoldavik, Vasternorrland, Sweden 1,579km NE

Redshank: An autumn passage bird controlled in its probable breeding area.

4	3.9.81	Terrington
v	20.4.87	South Uist, Western Isles, Scotland 696km NW

Turnstone: It is unusual to find Swedish birds wintering on the Wash and so perhaps this represents an overshoot to Sweden of one of the Greenland population which is known to winter on the Wash.

3	26.8.85	Nidingen, Halland, Sweden
v	28.2.87	Snettisham 879km SW

Black-headed Gull: The first two recoveries, of Norfolk-bred Black-headed Gulls demonstrate a typical westerly movement after the breeding season. (A similar pattern is shown by the breeding populations in Scandinavia, central and eastern Europe which move westwards into Britain). The remaining recoveries involve birds found wintering in different parts of eastern England, in subsequent years, apart from one in Hereford & Worcester which is most unusual.

1	10.7.79	Salthouse
xF	9.5.87	Alvaston, Derbyshire 168km W
1	4.6.86	Cantley
v	10.3.87	Wolverhampton, West Midlands 245km W

	23.12.81	Norwich
v	18.1.87	Loppem, West-Vlaanderen, Belgium 209km SE
6	6.1.79	Sheringham
vv	16.2.85	Gibraltar Point, Lincolnshire 60km WNW
vv	23.1.87	Skegness, Lincolnshire 62km WNW
5	17.1.85	Norwich
x	9.9.87	Bruisyard, Suffolk 44km SSE
6	26.1.86	Norwich
xF	27.1.87	Woolverstone, Suffolk 67km S
4	20.1.85	Downham Market
v	24.1.87	Pitsea Marshes, Essex 117km S
6	22.1.77	Ketteringham
v	17.1.87	Stretton Sugwas, Hereford & Worcester 275km WSW

Common Gull: This bird died of botulism six days after it was found.

5	14.1.87	Norwich
xF	15.3.87	Leigh on Sea, Essex

Herring Gull:

3	13.8.79	Wolferton
x	14.9.86	Newburgh, Grampian Region, Scotland 517km NNW

Puffin:

1	7.7.86	Farne Islands, Northumberland
x	28.12.87	Cley 348km SSE

Swallow: Although over 400 British-ringed Swallows have been recovered south of the Sahara, few had been ringed in Norfolk. The recovery at sea was of a bird found dying on board a yacht 100 miles off the western coast of Morocco. Was the southerly movement of the last bird a reflection of the miserable spring weather?

3	28.8.85	Happisburgh
v	15.10.86	Kapanga, Zaire 7,550km SSE
3J	29.8.86	South Lopham
xF	7.5.87	at sea, between Tanger and Las Palmas 2,573km SSW
4M	11.5.87	Happisburgh
xF	5.6.87	Flines les Rachas, Nord, France 291km SSE

Sand Martin: It is encouraging to see a rekindling of interest in Sand Martin ringing.

3F	1.8.85	Llangorse Lake, Powys, Wales
v	12.7.87	Loddon 330km ENE
3J	8.9.86	Farlington Marshes, Hampshire
v	12.7.87	Loddon 256km NE
2	7.9.86	Isle of Grain, Kent
v	18.7.87	Blackborough End 138km N

House Martin: One of the oldest House Martins to be reported from BTO ringing.

3	25.8.80	Happisburgh
x	23.9.87	Overstrand 18km NW

Blackbird: Note that all four Blackbirds recovered abroad were ringed within a ten-day period, at well scattered localities throughout the county.

6M	8.1.87	Ormesby St. Margaret
x	28.6.87	Steinfurt-Borghorst, Munster, FR Germany 381km E
6F	12.1.87	Sheringham
x	21.5.87	Utterslev, Lolland, Denmark 690km ENE

5F	16.1.87	Sheringham
x	12.4.87	Stocken, Goteborg och Bohus, Sweden 924km NE
6M	18.1.87	Norwich
v	22.3.87	Kampen, Overijssel, Netherlands 314km E
4F	27.10.84	Waxham
v	25.3.87	Spurn Point, Humberside 137km NW

Fieldfare: Killed by a hunter, part of the continuing massacre of passerines in the Mediterranean.

6	20.1.85	Sheringham
xF	25.1.87	Mungia, Vizcaya, Spain 1,120km SSW

Sedge Warbler: Many British Sedge Warblers leave the country via the south coast.

3	20.8.87	Earlham
v	1.9.87	Icklesham, Sussex 194km SSW

Reed Warbler: This bird must have flown at least 100,000 miles on migration alone by the time that it was retrapped in 1987.

4M	26.7.78	Earlham
v	28.6.87	Earlham

Goldcrest: In an autumn when so few Goldcrests were recorded on passage (only 53 were ringed in Norfolk), it is surprising that such an interesting control should have been reported.

3M	20.9.87	Calf of Man, Isle of Man
v	24.10.87	North Burlingham 446km ESE

Long-tailed Tit:

2	2.11.83	Happisburgh
xF	18.5.86	Impington, Cambridgeshire 117km SW

Coal Tit: Movements of over 100km are unusual for this species and yet there were four reported within Britain in 1986.

6	1.2.84	Snape, Suffolk
v	3.4.86	Snettisham 104km NW

Blue Tit: Several ringers commented on the abundance of Blue Tits in late autumn.

3F	22.10.87	Weybourne
xF	9.12.87	Boston, Lincolnshire 77km W

Great Tit: Further examples of spring movements of Great Tits.

4	13.4.86	East Winch
x	2.6.87	Attleborough 37km SE
3F	2.11.86	Landguard Point, Suffolk
v	31.3.87	Weybourne 114km N

Chaffinch: Note the amazing similiarity in the ringing and recovery dates of the two birds.

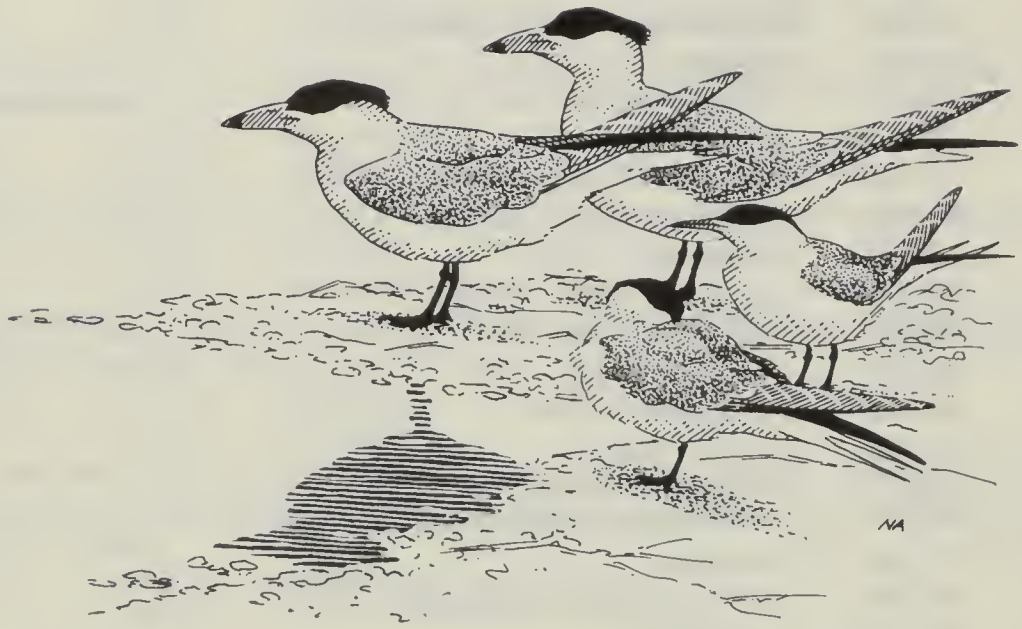
2	24.9.85	Kroonspolders, Vlieland, Netherlands
x	6.4.87	Necton 288km W
3F	26.9.85	Kennemerduinen, Noord-Holland, Netherlands
v	5.4.87	Sprowston 219km W

Greenfinch: As a result of increased interest in ringing Greenfinches in Norfolk, an unprecedented series of recoveries was reported in 1987. Of these, two-thirds were of birds controlled by other ringers. Space only allows those recoveries involving movements outside Norfolk to be given in full. The recoveries between Norfolk and Suffolk suggest that birds are tending to move north in autumn and south in spring,

particularly well shown by the multiple recovery from Ipswich. No clear pattern has yet emerged from movements between Norfolk and the other counties.

2	14.2.86	East Winch
x	15.6.87	Stowmarket, Suffolk 75km SSE
2	14.2.86	East Winch
x	8.4.87	Stowmarket, Suffolk 75km SSE
2	17.1.87	Pentney
x	27.4.87	Oakley, Suffolk 57km SSE
4F	27.12.86	Sheringham
x	15.10.87	Shadingfield, Suffolk 66km SSE
5M	29.3.86	Landguard Point, Suffolk
v	17.2.87	Sheringham 113km N
5F	28.6.85	Landguard Point, Suffolk
v	9.5.87	Weybourne 114km N
5M	28.4.86	Ipswich, Suffolk
v	29.11.87	Sheringham 100km N
5M	21.4.86	Ipswich, Suffolk
v	3.3.87	Sheringham 100km N
xF	23.5.87	Woodbridge, Suffolk 95km S
5M	17.2.84	Fakenham
v	6.12.86	East Grinstead, Sussex 119km SSW
2	29.12.85	East Winch
v	14.2.87	Milford, Staffordshire 169km W
2	25.1.86	Houghton
v	17.3.87	Corby, Northamptonshire 100km WSW
6M	25.1.86	Epping, Essex
v	18.2.87	Sheringham 160km NNE
2	17.10.86	Gibraltar Point, Lincolnshire
v	20.2.87	East Winch 44km S
3M	9.12.86	Walcot, Shropshire
v	25.4.87	Weybourne 251km E
3M	14.12.86	Huddersfield, West Yorkshire
v	11.6.87	Ormesby St. Margaret 260km ESE
6M	1.1.87	Millwater, Somerset
v	12.6.87	Ormesby St. Margaret 367km ENE
Siskin:		
5M	14.4.86	Sheringham
v	26.1.87	Rickmansworth, Hertfordshire 186km SW
Linnet:		
4M	5.9.86	Waxham
v	25.1.87	Beddington SF, Greater London 177km SW
Redpoll:		
2	28.6.86	King's Lynn
v	15.9.86	Brunoy, Seine-et-Oise & Seine, France 472km S
Reed Bunting:		
4M	9.11.84	Happisburgh
v	18.1.87	Ipswich, Suffolk 89km SSW

Classified Notes



These Notes are based on *Birds of Norfolk* (1977 revised edition) where information regarding status, distribution, migration and ringing recoveries may be found. Details covering the complete Ouse Washes appear in the Cambridge Bird Club Report for 1987. Attention is drawn to the wealth of Migration observations appearing in the quarterly bulletins of Cley Bird Club and also featuring in NOAs 1987 Annual Report where the coastal accounts extend to Breydon Water. In addition NARVOS Report for 1987 contains considerable detail regarding distribution in west Norfolk.

The order used is that of K. H. Voous (1977) List of Recent Holarctic Bird Species. Observations refer to 1987, unless otherwise stated. To save space, all but the most essential initials have been omitted. Records are of single birds unless otherwise stated.

Red-throated Diver: Inshore records in all months. Peak counts: 203 Cley Jan 31st, 140 Cley-Salthouse Feb 13th-14th and 107 Paston Nov 20th.

Inland at Horsey Mere March 15th, Martham Broad April 18th-May 25th, Strumpshaw 2 West Nov 26th, Brundall 2 west Dec 3rd, Hickling Dec 19th and Buckenham Dec 21st.

Black-throated Diver: Over 70 coastal reports mainly between Cley and Hunstanton, but including 7 East Coast observations and one off Heacham. Extreme dates May 21st and Sept 7th. Majority singles, but ones and twos also recorded. Inland: Breydon March 14th and Welney March 15th.

Great Northern Diver: Over 30 records of singles in coastal waters Yarmouth-Hunstanton up to May 28th and from Sept 3rd. Birds retaining breeding plumage in Holkham Bay Oct 13th and off Cley on 19th.

Little Grebe: As usual only winter assembly at Snettisham where maximum of 35 Sept.

Great Crested Grebe: August concentrations included 68 at Breydon and 126 off Snettisham followed by 50 off Hunstanton Oct 12th.

Red-necked Grebe: Over 80 coastal observations, the majority relating to singles, but also twos, threes and fours. Noted to April 2nd (with one in breeding plumage at Cley July 19th) and from Aug 12th.

Inland at Breydon, Denver Sluice, Filby, Gt Melton, Hickling, Pentney GP (June 4th), Potter Heigham, Rockland/River Yare (long stayer Jan 22nd-April 7th) and Welney.

Slavonian Grebe: Autumn influx into Holkham Bay commenced Oct 5th reaching maximum of 14 Nov 7th and with 5 till Nov 9th. Elsewhere up to 6 Jan-March and Sept-Dec between Paston and Heacham. Only one East Coast occurrence (Yarmouth Jan 2nd). In Fens singles on Ouse at West Lynn Jan 4th and Nov 21st.

Broads: Filby Feb 16th/17th; West Somerton Dec 24th-26th; Horsey Mere Jan 9th and Hickling Feb 1st, Nov 29th/30th and Dec 12th-19th. Other inland birds at Lyng GP Feb 9th and Welney Feb 22nd.

Black-necked Grebe: Group of 10 in Blakeney Pit towards end of 1986 remained till Jan 3rd with 7 lingering till 10th. Other inshore records at Horsey Jan 9th, Sheringham 3 West Aug 26th, Cley Jan 7th and Oct 24th and Holme Nov 9th-11th and on many dates in Dec. East: Breydon Jan 21st.

Singles in full breeding plumage at Brevdon and Hickling April 24th, Martham Broad April 29th-May 2nd, Narford Lake May 4th, Tottenhill GP May 11th-14th and Pentney GP May 14th/15th.

Fulmar: Hunstanton: 50 pairs Jan 12th and 63 young counted Aug 8th. First returned Nov 1st and 50 pairs again by year-end. No details available for North Coast. Inland: Thurne June 21st.

Cory's Shearwater: Hunstanton Sept 26th (HR).

Sooty Shearwater: Small scale movements Aug 24th/25th when moderate to strong northerly winds accompanied by heavy rain. Records include Horsey 2, Waxham 4, Walcott 5, Paston 9 + 6, Sheringham 4, Weybourne 5, Cley 9 + 15 and Snettisham 2.

Further small movement Sept 26th during strong NW winds: Waxham 1, Paston 2, Mundesley 1, Sheringham 2, Cley 6, Blakeney Point 1 and Hunstanton 1. Otherwise extreme dates July 22nd and Oct 19th apart from highly unusual occurrences off Cley Jan 14th (ETM) and off Paston March 29th (MF).

Manx Shearwater: Apart from 5 west off Holme May 21st all observations between July 20th and Oct 17th with largest parties Aug 24th (12 off Cley) and Sept 26th (8 off Hunstanton).

Storm Petrel: Blakeney Point Jan 25th (PG).

Leach's Petrel: Cley/Salthouse Sept 26th (EJH SPH ETM).

Additional 1985: Sheringham Nov 10th (RJW).

Gannet: Peak easterly movements off Paston: 644 Aug 24th and 334 Nov 1st.

Cormorant: Largest roosts: Ranworth: 267 Feb, 195 March, 330 Oct, 257 Nov and 260 Dec. Welney: 118 Jan, 131 Feb, 167 March, 80 April, 30 May, 110 Nov and 135 Dec. Holkham: 216 Sept.

Shag: Usual coastal reports of 1 to 3 up to May 4th and from Aug 28th. Largest parties totalled 5 (Brancaster and Cley). At Wells up to 3 Sept 11th onwards.

Bittern: In Broadland only 3 regular boomers. North coast: Again 5 boomers at four sites. Autumn/winter records from Burnham Overy, Hickling, Holme, Horsey,

How Hill, Irstead, Pensthorpe Hall, Ranworth (3 high over the marshes Oct 22nd), Rockland, Rollesby, Salthouse, Strumpshaw, Thompson Water, Wells, West Acre (dead — entangled in netting) and Woodbastwick.

Night Heron: Blackborough End adult April 26th-29th (AB BJB NB *et al*), Breydon sub-adult Aug 29th (PRA LCS) and East Rudham adult Nov 14th-16th (NB KF).

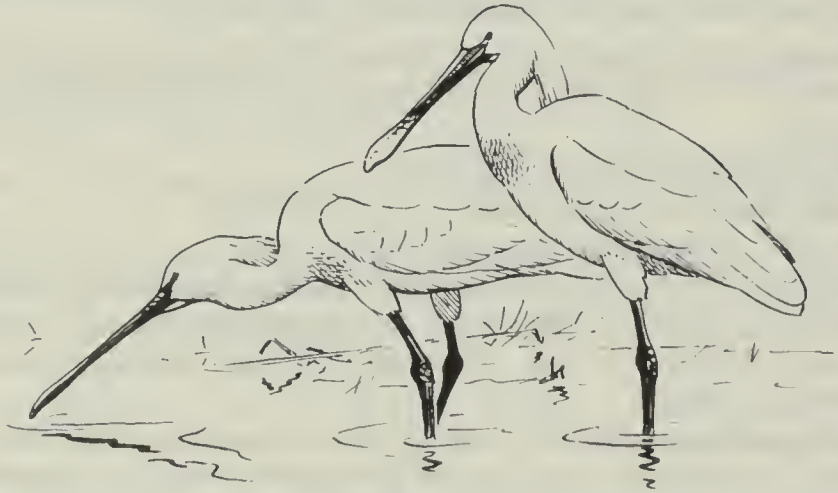
Grey Heron: Heronry details include Barton 4, Bawburgh 3, Buckenham 10-12, Burgh Castle 2, Cockshoot 1, Didlington 3, Fleggburgh Common 3, Fritton 3, Gt. Witchingham 3, Hilgay 31, Holkham Park 4, Islington 79, Narford 5, N. Elmham 8, Old Hunstanton 9, Potter Heigham (Heigham Sounds) 11, Quidenham 3, Ranworth 4, Shadwell 3, Snettisham 6, Sparham 16, Sturston 7, Surlingham 2 and Wheatfen 2.

Purple Heron: Cley May 29th (CBC), Ranworth May 31st (DNA GT) and Welney sub-adult June 24th-Aug 31st (JBK *et al*).

Spoonbill: Ones and twos (together with up to 4 at Titchwell May 27th to June 1st) at Blakeney, Breydon, Cley, Hickling, Holme, Horsey, Hunstanton, Lynn Point, Salthouse and Weybourne. Extreme dates April 7th and Oct 5th.

An immature at Cley Aug 21st (ringed in Holland June 12th) remained till Oct 4th.

Additional 1986: Sennowe Park GP July 21st.

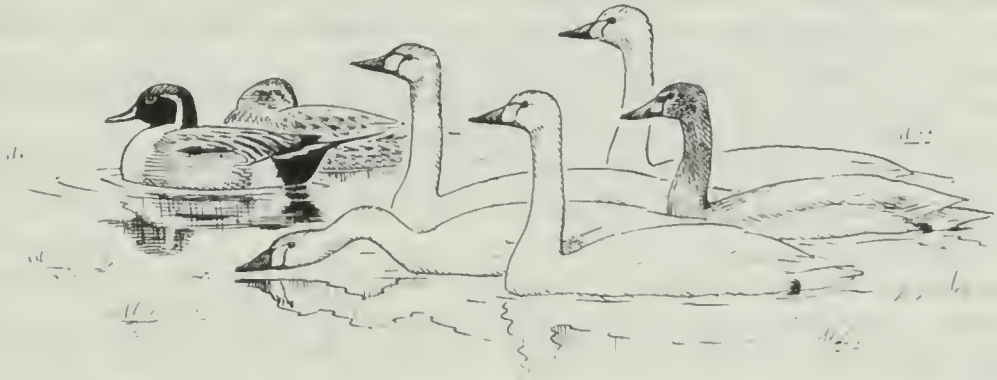


Bewick's Swan: Total Ouse Washes (Cambs/Norfolk) counts of 6,100 Jan 19th, 5,695 Feb 16th, 1,476 Nov 16th and 3,200 Dec 14th when 8½% young. Two injured

birds summered at Welney.

In Hickling-Horsey-Breydon-Halvergate-Haddiscoe areas peaks of 260 Jan and 300 Feb but due to mild conditions end of year total did not exceed 100 birds.

Spring easterly exodus most noticeable March 11th (100 Cley), 14th (110 Lyng, 200 Colney and 150 + 100 Norwich) and 18th (70 Yarmouth). Autumn arrival from Sept 23rd (Welney).



Whooper Swan: Ouse Washes: At Welney 350 Jan 6th, 317 Feb 16th (when 470 on complete Washes), 340 March 4th, 72 April 2nd, 34 April 9th and 6 April 16th; 6 early returns Sept 27th followed by 38 Oct 12th, 230 Nov 15th, 433 Dec 9th and 466 Dec 14th (when 504 on complete Washes). Same 2 injured birds again summered. 18% young in Dec. Several Caerlaverock-ringed birds seen in Dec as well as several Icelandic-ringed birds. Also a Danish-ringed bird in Dec.

Broads: In Hickling-Horsey area up to 32 Jan, 91 Feb, 45 March, 42 Nov and 49 Dec.

Bean Goose: Yare Valley: 1986/7 winter: 284 Jan 28th and peak of 310 Feb 24th. Most departed last days Feb but 17 present first week March with 2 till April 6th.

Yare Valley: 1987/8 winter: Late autumn return began Nov 10th (4) followed by 30 on 23rd with an influx in first week of Dec: 255 on 6th and 342 on 8th. By latter date total included 22 carrying neck-collars. These formed part of a catch of 36 made July 20th 1987 in southern Lapland, Sweden, where a moulting flock of 300 non-breeders recently discovered. This is first proof of origin of at least part of the wintering flock.

It was remarkable for such a high proportion of one catch to be found in a single wintering area. So far none of the 22 Yare valley birds has been reported elsewhere despite enquiries in Holland, West Germany and Denmark. Only other substantial flock of *fabalis* in Britain (in Central Region of Scotland) contained no neck-banded birds among 122 individuals Dec 5th.

Further increases totalled 404 *fabalis* Dec 14th with a peak of 420 (including 16 juveniles) Feb 3rd. Departure of the main flock (earlier than usual) Feb 16th to 18th with last 29 (none neck-banded) March 1st which flew off high to NE as if migrating.

Since reaching a low of only 25 (1964) numbers in the Yare valley have increased steadily (apart from temporary fluctuations) to present record numbers which occurred during an exceptionally mild winter. Arrival pattern differed from other recent winters. Usually the 'normal' population arrives by mid-Dec followed by a cold weather influx. This winter virtually all arrived well before Christmas. Early arrival of the entire population was probably due to a short spell of cold weather in the Baltic at the end of Nov. Many more Bean Geese than usual over-wintered in Southern Sweden. In the Low Countries *fabalis* numbers were much smaller than

usual, totalling only 3,000 birds.

Parties of up to 6 Russian Bean (*rossicus*) noted in Yare Valley Dec 14th-Feb 11th (East Norfolk summary by MO).

Elsewhere: Halvergate: up to 30 on 5 dates in Dec. Brograve: 19 *rossicus* with a single Barncale Goose Dec 25th onwards. Holkham: 2-3 Jan 22nd to March 12th. Welney: 21 *rossicus* Dec 20th/21st and 23 on 22nd till 27th.

Pink-footed Goose: Co-ordinated dawn counts along The Wash and on the north Norfolk coast, combined with feeding ground estimates, indicated the following figures for the wintering population in NW Norfolk:

1986/7 winter: Peak of 19,800 Dec 28th; Scolt roost abandoned following heavy snowfalls in early Jan. Last recorded April 22nd.

1987/8 winter: Early arrival (20) Sept 18th with additions (28) Sept 22nd and 110 Sept 28th increasing to 17,000 Dec 20th and to peak of 18,800 Jan 9th declining to 8,800 Feb 6th.

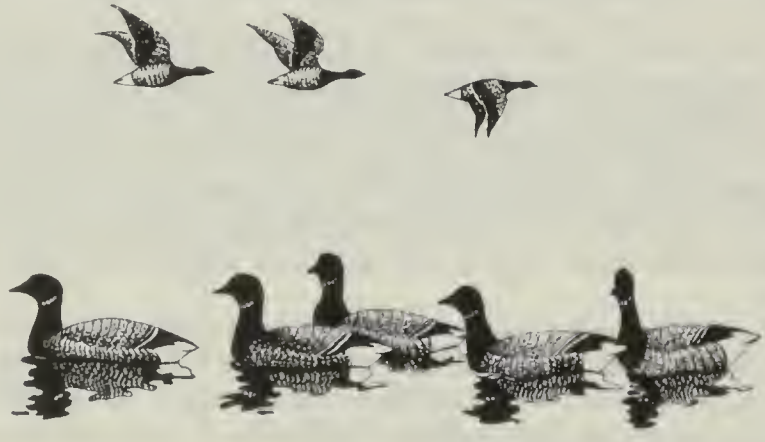
White-fronted Goose: Holkham/Wells monthly maxima: 140 Jan, 172 Feb and 232 till March 17th; 10 very early birds Oct 8th-21st, 40 Nov and 195 Dec.

Yare Valley: 43 Jan, 40 Feb and again from Dec 5th with end of year peak of 250-265.

Welney: 7 Dec 2nd and peak of 130 (24 young) Dec 21st-23rd with 80 at year-end.

Barnacle Goose: 1-3 appeared among NW Norfolk Pink-Feet and another with Welney White-fronts. Small influx during Dec including 20 Breydon/Berney 7th-20th, 12 higher up Yare Valley (8 of which visited Hardley Flood) and 5 at Cley.

As in previous years 5-6 lingered at Cley May 2nd-19th repeatedly heading out to sea (this pattern is discussed in 1983 Report p. 380).



Brent Goose: A co-ordinated count on North coast between Holme and Salthouse (but excluding Warham saltings due to snow) Jan 25th produced total of 9,800. As in previous year breeding season on Russian tundra virtually a complete failure. Main exodus during third week of March with autumn return from Sept 22nd. Further count on North coast in Jan 1988 produced total of 9,450.

Wash: Peak of 3,500 at Ouse Mouth Jan 31st, 1,200 Wootton Marsh Feb 8th, 500 Snettisham till mid-May and 1,000 at Ouse Mouth Nov 14th.

Unusual inland arrival at Pentney GP of 13-14 Jan 27th-Feb 4th.

Pale-bellied *hrota* in groups of up to 15 appeared at usual haunts.

Black Brant *nigricans*: 2 remained in Weybourne, Salthouse, Cley areas until Feb 28th (ETM *et al*) with one at Stiffkey Jan 11th. Another in same localities Dec 5th onwards. Also Lynn Point Dec 17th onwards (NB *et al*).

Additional 1986 *nigricans* at Overy Staithe Jan 19th (AB DF).

Red-breasted Goose: An adult in Cley, Salthouse, Blakeney and Langham area Dec 7th onwards (ZO *et al*). Fourth county record.

Egyptian Goose: Holkham main locality where peak of 120 mid-July. In addition 26 Babingley, 27 Flitcham, 27 Pentney, 40-50 South Acre and 34 Sparham.

Shelduck: Wash counts at Snettisham included 3,100 Jan, 3,000 Feb, 2,400 March and 1,150 May. Ouse Mouth to Wolferton 5,000 Jan 31st. At Breydon peak of 1,307 Jan 12th — second highest count. Hard-weather movement of 1,218 west at Paston Jan 10th. At Wells/Warham influx of 1,420 Jan 26th.

Inland breeding at Cantley BF (260+ juveniles), Cockley Cley, Harpley Dams, Helhoughton, King's Lynn BF, Pentney GP, Rockland Broad, Thompson Water, Tottenhill GP and West Acre.

Mandarin: Ones and twos at Felbrigg, Gunton Park, Hillington Park, Holkham Park, Holt Hall, Norwich, Pentney GP, Thelverton, Thetford, Wells and Welney.

Wigeon: Highest estimates: Welney 12,100 Jan, 12,920 Feb, 5,780 March (when total Washes count 42,175), 4,200 Oct and 4,340 Nov. Buckenham 8,000 Jan. Breydon/Berney 2,200 Dec. Paston 1,100 west Jan 10th at onset of cold spell.

American Wigeon: Single drakes at Welney March 13th (JBK DR) and at Cley June 22nd (RC SJMG).

Gadwall: Highest counts: Narford 200 July, Stanford Water 213 Aug and Gunton Park 389 Sept and 371 Oct.

Norfolk remains British nesting stronghold with county total of 150-200 pairs.

Green-winged Teal: Additional 1986: Drake at Welney Dec 10th (NB). The Cley June 1986 individual also observed June 27th.

1985: The bird at Wells Nov 24th should be deleted. It was in fact released by Wells wildfowlers in Sept together with 2 Red-crested Pochard.

Pintail: Largest totals: Breydon 264 Jan, Cley 300 Dec, Blakeney 600 Nov, Snettisham 330 March, Welney 895 Oct and 300 Dec and Narford 174 Oct.

Garganey: Spring arrival from April 5th (Cley and Strumpshaw) followed by 1-5 at Berney, Breydon, Hickling, Holme, Horsey Mere, Little Ouse Washes, Rockland Broad, Salthouse, Snettisham, Stiffkey, Surlingham, Titchwell, Tottenhill GP, Welney and West Acre. Latest Cley Oct 7th where 5 juveniles July 28th.

Blue-winged Teal: Cley: A drake in eclipse Sept 16th to 19th and Oct 10th to 13th (TEB CRK *et al*).

Shoveler: Largest assemblies: Hickling 134 Sept, Ranworth 122 Nov, Narford 124 Oct and Welney 254 Jan and 200 Dec.

Red-crested Pochard: Cley 2 Feb 14th; Snettisham Oct 22nd and Dec 12th; Welney Jan 3rd to Feb 6th; Narford 2 drakes Jan 10th and on following dates: Feb 8th, June 6th, July 12th, Aug 7th, Aug 27th and Nov 7th. Local status confused by escapes from collections.

Pochard: Highest counts: Welney 520 Jan, 976 Feb, 535 March, 246 Oct, 536 Nov and 820 Dec. Elsewhere: Hickling 332 Feb, Tottenhill GP 227 Oct and Pentney GP 220 Dec.

Ring-necked Duck: Hardley Flood: a drake May 2nd to 29th (JCE *et al*).

Tufted Duck: Winter counts included Denver Sluice 300 Jan and Tottenhill GP 299

Oct and 280 Nov.

Scaup: The Wash attracted largest numbers: Hunstanton 200 March and Heacham 220 Jan and 200 Feb. Singles inland at Claxton, Downham Market Relief Channel, Hillington Lake and Strumpshaw.

Eider: Concentrations included: Heacham 60 Jan 31st; Paston 107 west Nov 24th and Weybourne 53 Nov 25th.

Inland: Downham Market Relief Channel Jan 23rd to 26th.

Long-tailed Duck: Most regular off Hunstanton/Holme where following monthly totals: 150 Jan, 30 Feb, 76 March, 60 April and 30 Dec. Two East Coast records: Gorleston Yacht Pond Nov 14th/15th and Yarmouth Nov 26th. No inland observations.

Common Scoter: Most impressive inshore counts: Holkham Bay 250 Jan and Hunstanton/Holme 500 Feb, 450 March and 310 Dec. Inland: Swanton Morley GP March 4th, Rockland Broad Sept 3rd and Welney Oct 19th.

Velvet Scoter: Recorded monthly except June/July. Largest groups off Heacham/Hunstanton where 68 Jan, 140 Feb and 60 March. Inland: Breydon Jan 20th to Feb 11th and Ranworth Broad 2 Jan 24th and one 25th.

Goldeneye: Jan peak counts: Breydon 45, Hickling 35, Blakeney 74, Holkham Bay 35, Hunstanton/Holme 130, Snettisham 69, King's Lynn 36 and Ouse Relief Channel 74.

Smew: Recorded to April 16th (Ranworth). Main arrival during severe weather in Jan with a number staying until mid-March. During this period most impressive groups at Denver Sluice (9 Jan 17th), Downham Market (12 Feb 4th) and Hickling (10 (3 drakes) Feb 23rd, 13 (4 drakes) Feb 27th and 14 (3 drakes) March 14th).

Smaller parties (1-8) at Barton Broad, Beetley GP, Berney, Breydon, Brundall, Buckenham, Burgh Castle, Cley, Cockshoot Broad, Colney GP, Holme, Horsey, How Hill, Lower Bure, Lyng, Magdalen, Martham, Pentney GP, Postwick, Ranworth, Reedham, Rockland, Sparham, Snettisham, Stowbridge, Surlingham, Tottenhill GP, UEA Broad Earlham, Welney and Worthing.

End of year 1-2 at How Hill, Lyng Bridges, Ranworth, Tottenhill GP and Welney.

Red-breasted Merganser: As in previous winters severe weather in Jan resulted in an influx to the Fens. Between Jan 16th and March 22nd up to 6 recorded at Denver Sluice, Downham Market, Magdalen, Saddlebow, Stowbridge and Ten-mile Bank (with a maximum of 16 between Denver and King's Lynn Jan 23rd). Elsewhere inland: Colney GP Jan 11th and Hickling 5 Jan 31st.

Largest coastal numbers: Blakeney 40 Jan; Snettisham 73 March and Hunstanton/Holme 50+ Nov. An injured bird summered in Breydon/Berney area; earlier it was at Surlingham May 11th-24th.

Goosander: Greatest numbers (as in previous cold spells) assembled in the Fens. Between Denver Sluice and King's Lynn 54 (23 drakes) Jan 17th and 69 (31 drakes) following day. Between Denver and St. Germans peak of 100+ Jan 31st including 42 on a short stretch between St. Germans and Wiggenhall St. Peter.

Also recorded at Antingham, Breydon, Cantley, Carrow Bridge Norwich Feb 23rd to March 6th, Gunton Park, Hickling 12, Paston, Postwick 9, Ranworth 18, Sparham, Stowbridge 22, Strumpshaw, Surlingham and Welney. A drake remained at Breydon Feb 7th to July 14th.

Ruddy Duck: Singles at Lang Mere, Lyng, Narford, Ranworth, Sparham, Tottenhill GP and Welney.

Honey Buzzard: At least one pair summered in the county. Frequent display flights observed, but no proof of successful breeding.

Black Kite: Hickling April 11th (CRJ DP DS *et al*) and almost certainly the same bird over Blofield April 12th (GSB JC). Singles near Castle Acre May 3rd (NAD), and Repps May 9th (JRW).

Red Kite: Following observations considered to relate to the same bird: Beeston and Felbrigg Jan 4th, Snettisham Jan 10th, Cromer Jan 27th, Brancaster Feb 21st; Holme, Titchwell, Warham, Stiffkey, Blakeney and Cley all Feb 24th; Cley Feb 25th/27th, Warham Feb 22nd and 27th and Felbrigg March 8th.

In addition singles at Horsey Feb 28th, Hickling March 13th/14th and Brundall Dec 14th.

Marsh Harrier: County summer total of 29 males and 31 females. 58 young reached the flying stage. At principal Broads winter roost (shared with Hen Harriers and Merlins) 3 in Jan, 2 Feb and 3 Oct onwards.

Hen Harrier: Recorded up to May 13th (Cley) and 14th (Weybourne) and from Sept 20th (Cley).

Information available for 11 roost-sites gave a county total in Feb of 46+ birds. At most important Broads roost up to 7 present Jan/Feb, 6 March, 4 Nov and 8 Dec.

Montagu's Harrier: Recorded April 26th to Sept 14th. Three females (and 2 males) bred at three sites fledging a total of 9 young. In addition total of 17 mainly coastal migrants.

Goshawk: One pair attempted breeding, but nest robbed. Singles elsewhere at East Wretham Feb 15th, Brundall June 17th, Hickling Nov 2nd and Northrepps Nov 4th.

Sparrowhawk: Recorded at 164 localities.

Buzzard: Ones and twos at Caister, Cley, Corpusty, Cromer, E. Ruston, East Winch, Felbrigg, Feltwell, Flitcham, Glandford, Hickling, Kelling Heath, Lound, Muckleboro' Hill, Norwich, Paston, Ridlington, Salthouse, Sea Palling, Thorpe St. Andrew, Waxham, Wereham, Weybourne, Winterton and Waxham. Also 3 in Horsey-Winterton area May 2nd. Recorded each month of year with majority during April.

Rough-legged Buzzard: Compared with 1986 abundance only 3 records: South Pickenham Feb 22nd, Haddiscoe Island March 12th and Upper Sheringham April 14th.

Osprey: Extreme dates April 17th (Weybourne) and Sept 23rd (Norwich). Singles recorded at Cley, Cockshoot/Ranworth, Coltishall, Hickling, Holme, Horsey, Horstead, Lound, Martham, Muckleboro' Hill, Paston, Surlingham, Thompson Water, Titchwell, Tottenhill, Tottington, Weybourne, Wiveton and Yarmouth.

Kestrel: Snettisham: Early autumn peak of 21 Aug 31st.

Red-footed Falcon: Choseley female May 26th (JW PHW); Horsey adult male May 27th-30th (PRA TEB GED SL NM).

Merlin: Recorded at well over 30 localities up to May 15th (Weybourne) and from Oct 16th (Welney). Roosting details from 3 sites: Broads (8 Jan, 7 Feb, 10 March, 3 Oct, 4 Nov and 6 Dec); West (3 Jan, 4 Feb, 1 Nov and 4 Dec) and Fens (4 Jan to March, 1 Oct and 2 Nov-Dec).

Hobby: Single pairs bred at 2 sites raising 2 and 3 young respectively. Recorded at over 50 localities between April 27th and Sept 21st (Fowl Mere).

Peregrine: Snettisham/Wolferton: 6 sightings during March. Another wintered from Dec 18th onwards between Blakeney Point and Wells. Dersingham Fen: Male roosting Dec 28th-31st.

Additional observations (to April 23rd and from Sept 7th) at Brancaster, Burgh Castle, Burnham Deepdale, Cley, Flitcham, Heacham, Holkham, Holme and Titchwell.

Quail: Calling at Ashill, Cawston, Choseley, Didlington, East Wretham, Flitcham, Frog Hill (Stanford Battle Area), Holme, Horsey, Marham, Ringstead (3), Shingham, West Acre and Weybourne.

Golden Pheasant: Reported from Cockley Cley, Drymere (11), East Wretham (18), Harling, Hockham Fen, Narford, Sandringham, Santon Downham, Stonebridge, Thetford GC, Thompson, Warren Lodge (10), Wayland Wood and Wolferton.

Water-Rail: Three breeding localities: Strumpshaw, Surlingham Church Marsh and Hillington Park. A migrant at Blakeney Point Oct 23rd.

Spotted Crake: Welney: Calling May 27th. Holme immature Sept 3rd to 11th and Titchwell Sept 12th.

Corncrake: Welney: Calling May 13th to 15th (JBK).

Crane: Six present in Broadland at beginning of year and until Jan 12th when all departed following heavy snowfall. Three returned by March 7th with remaining 3 appearing on 11th after being reported over Stodmarsh in Kent the previous day. At least 4 summered and 6 again present during Dec.

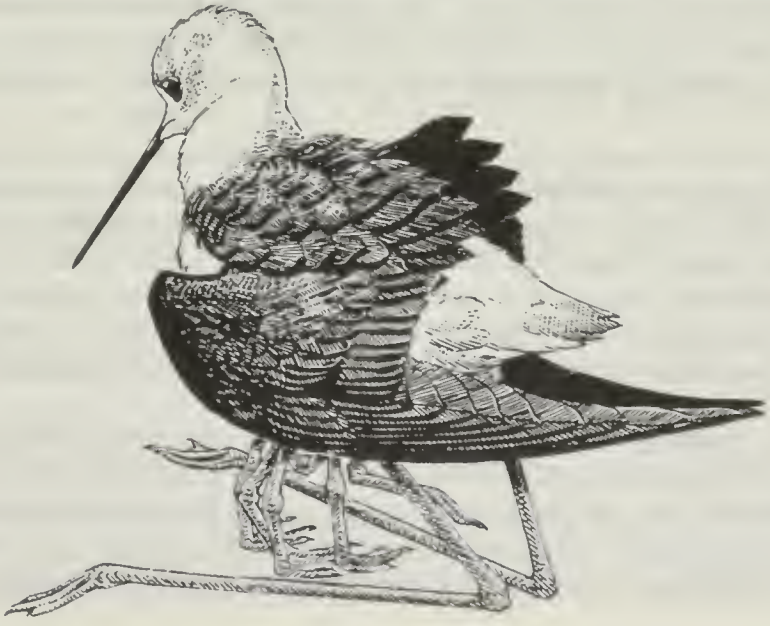
Almost certainly members of the long-staying Broads group provided the majority if not all of the following occurrences: Cley March 26th; Blakeney Eye, Cley and Hempstead 2 April 25th-27th; Strumpshaw 2 May 2nd; Holme May 16th; Wells and Cley May 17th; How Hill 2 June 13th; Strumpshaw June 22nd and Dersingham/ Snettisham/North Wootton Sept 26th to Oct 22nd.

Great Bustard: New Buckenham: 2 Feb 7th to 10th (AJP *et al*). First county record since 1979. See page 97.

Oystercatcher: Peak counts on the Wash at Snettisham were 12,500 Jan and 10,642 Oct.

Coastal breeding season records included 170 pairs Blakeney Point and 99 nests Scolt. Continues to spread inland and following summary of breeding localities covers period 1978-1987: Anmer, Babingley, Billingford near Diss, Binham, Bircham, Blakeney, Bradwell, Brancaster, Breydon, Burgh Castle, Crostwick, Downham Market, Dunton, Feltwell, Flitcham, Fring, Fritton, Gillingham, Gt. Snoring, Gt. Yarmouth (Western Bypass), Hardley, Harpley, Hickling, Hillington, Hockwold, Horsey fresh-marshes, Houghton, Kelling, Kettlestone, Langley, Letheringsett, Lt. Ryburgh, Ludham, Narborough, Narford, North Creake, North Elmham, Norton Subcourse, Pensthorpe, Pentney, Potter Heigham, Raynham Park, Reedham, Roydon, Saxlingham, Saxthorpe, Sculthorpe, Sennow, Stanhoe, Stiffkey, Stow Bardolph, Swanton Morley, Swanton Novers, Syderstone, Tattersett, Terrington, Fring, Walpole St. Peter, Warham All Saints, Wells, Welney, West Acre, West Caister, West Lynn, West Somerton, Wickhampton, Wighton and Worthing.

Black-winged Stilt: Pair arrived Holme May 17th and settled down to breed with first egg laid only 4 days later on May 21st. Three young hatched, 2 surviving to fly-



ing stage. Adults remained to Aug 18th, young last seen Aug 31st. Frequent visits to Titchwell Aug 2nd to 31st. Juveniles appeared at Belvide Res Staffs Sept 1st to 7th. Subsequent reports of single juvenile from Humberside Sept 13th and Tyne and Wear Sept 15th. See page 89.

1983 additional: Wisbech SF female April 29th (JAWM). Doubtless one of the party of 4 visiting the Nene Washes early in April; a pair returned early in May to nest but the clutch of 4 eggs was taken.

Avocet: As usual Cley hosted the majority of breeding birds with 65 pairs rearing 120 young to flying stage. Also a further 3 pairs reared 8 young nearby. Continues to increase at Titchwell where 27 pairs reared 50+ young. Up to 6 pairs at Holme in spring, but none bred.

Some post-breeding movements are occurring, presumably in search of adequate food supplies and several flocks were noted. A peak of 102 at Titchwell July 26th at high tide roost, 24 Holme Sept 27th, 55 Lynn Point Aug 23rd — these birds feeding on the tidal zone, 11 Hickling Aug 10th and 8 Breydon Aug 22nd.

Also appeared during year at Fleggburgh Common in May, Old Hunstanton where 4 displaying on beach April 26th, Snettisham throughout summer (with one remaining till year-end with Oystercatchers) and Welney (March and April).

Stone Curlew: First Weeting Heath March 28th. Total of 39 pairs in Norfolk Breck. Largest Breckland concentration 25 Aug 20th.

Little Ringed Plover: A few early arrivals at end of March: Pentney GP 27th; Salthouse 28th; Welney, Lyng Easthaugh and Colney GP 29th. Latest date: Sept 19th at Holme.

Rather low total of 21 pairs on territory and only a few of these actually reported as rearing young.

Widespread on autumn passage in small numbers peaking late July when 10 Cley 19th, 7 Holme 19th and 9 Wissington BF 23rd.

Ringed Plover: Counts of 80-90 breeding pairs Blakeney Point and 162 nests Scolt. Also 11 inland pairs at Hillington, King's Lynn BF (2), Welney (2), Wretham, Thompson, Lang Mere, Bodney, Tottenhill and Cockley Cley.

Concentrations of migrants included a peak of 351 *tundrae* Breydon May 16th, 60 *tundrae* Cley Aug 16th, 500 Ouse Mouth Aug 8th and 1,000 Snettisham July 12th.

Kentish Plover: Remaining scarce, the only records concern a female Hickling May 16th/17th and a male Cley/Salthouse May 23rd.

Dotterel: A wintering individual at Cley first seen Nov 9th 1986 remained until Jan 9th.

Spring passage commenced early with 2 at Weybourne April 28th/29th. This was followed by others at Winterton/Hemsby: 7 May 6th and one May 7th; Happisburgh/Eccles: 6 May 2nd, one May 4th, 5 more May 16th and singles May 17th and 27th; Thornham: 4 May 22nd/23rd. Largest numbers on black fenland at Ten Mile Bank continuously May 1st to 26th, initially 16 but peaking at 18 May 7th followed by counts of 11 May 11th, 13 May 16th, 9 May 15th, 6 May 20th, 9 May 24th and 2 May 26th. Acknowledgement is due to the farmers in allowing access to this site for numerous bird-watchers.

Autumn produced singles at Yarmouth beach Aug 26th-28th, Waxham juvenile Aug 30th, Weybourne Aug 26th and Cley Beach juvenile Aug 30th/31st and Sept 6th.

Golden Plover: Largest flocks reported were an early gathering of 300 Lynn Point Aug 8th increasing to 1,500 Aug 23rd, 700 Wereham Nov 5th, 450 Wretton Dec 24th, 600 Shipdham Oct 11th, 350 Hockering Nov 10th and 600 Cley Feb 22nd.

Grey Plover: Major concentrations included 1,200 Ouse Mouth Aug 15th while Snettisham had 1,300 Jan 4th, 475 May 17th and 950 Sept 13th. Other notable counts were 800 Blakeney harbour (Aug) and 110 Brancaster harbour Feb 27th.

Knot: Counts on the Wash at Snettisham: 11,000 Jan 27th, 15,000-20,000 Feb 1st and 21,000 Aug 15th. Also 20,000 Holme Sept 24th and 8,000 Titchwell Sept 7th. Thousands of Knot and other waders may be observed on rising spring tides flying north-east past Hunstanton then east beyond Holme to high-water roosts at Titchwell and Scolt.

Several inland records from Welney including 65 north Jan 23rd.

Sanderling: Largest roost counts from the Wash at Snettisham: 625 Jan 4th, 457 May 17th and 725 Aug 15th. Other significant counts included 285 Paston Jan, 130 Burnham Overy May 6th, 175 Holme Sept and 100 Hunstanton Oct 29th.

Inland sightings: 3 on the ice Rockland Broad Jan 24th; singles at Welney May 9th, May 21st, May 30th and Oct 16th and Pentney GP July 23rd.

Little Stint: The year opened with an unseasonal bird at Titchwell Jan 3rd and 8th followed by the equally unusual sighting of a single at Hickling March 31st.

Spring migrants at Hickling May 4th-17th maximum 3, followed by singles on 4 dates in June. Cley produced singles April 25th to 30th, May 2nd, 9th and 10th with 3 on 25th, 5 on 26th and 3 on 31st. Singles at Titchwell May 13th, 20th and June 13th and another single Holme June 10th and Pentney GP May 25th-27th.

Rather low numbers on autumn passage. At Hickling 2 Aug 8th, one 13th, 4 Aug 22nd and 10 Aug 24th with a final bird Sept 23rd. Cley had up to 6 between July 22nd and Sept 26th with 5 Oct 15th, 8 Oct 11th and a late bird Oct 31st. Peak at Titchwell: 15 Aug 30th; small numbers at Holme July 29th-Sept 29th and 4 Lynn Point Aug 23rd.

Temminck's Stint: As usual most records from Hickling and Cley, the former recording spring passage between May 2nd and 31st with a peak of 6 birds on 17th. At Cley similar passage with a peak of 8 on 17th. Also recorded at Holme May 17th to 23rd with 2 on the first and last dates when one in display flight and singing. A further scattering of spring records from Breydon June 3rd, Colney GP May 24th/25th, King's Lynn BF May 2nd-10th, Hardley Flood May 25th, Blakeney Point 2 May 23rd on mud in harbour, Titchwell May 19th and June 7th and Welney May 9th/10th where another May 18th-22nd.

A lighter autumn movement with birds at Hickling July 31st-Aug 3rd, Cley July 14th-16th, July 23rd, 2 July 24th/25th, 2 Aug 28th, 4 Aug 29th-Sept 3rd, 3 Sept 4th/6th. Also at Holme Aug 2nd, King's Lynn BF Aug 26th-29th and Dickleburgh Moor Sept 2nd.

Pectoral Sandpiper: A typical collection of records: Hickling July 2nd (MJS SFS) and Aug 2nd/3rd (PJH SL), Cley Sept 11th/12th (RP CK), Wissington BF July 26th-Aug 1st (MR CD) and a bird at the site of the old Wisbech BF Aug 1st (JAWM).

1983: A previously unsubmitted record of a bird at Cley Aug 29th (OJB).

Curlew Sandpiper: Several migrants in May including up to 7 Breydon 9th-31st, 2 Hickling 17th and 26th, 2 Hardley Flood 9th plus another 27th, Cley 3rd-24th with maximum of 3 on 11th, 17th and 23rd, Scolt 25th, Titchwell 10th/11th with 2 on 24th and Holme 23rd; also 2 Breydon on the odd date of June 25th.

Red adults had returned by July 19th (Cley) and 20th (Breydon) with first juveniles following by Aug 22nd at Breydon where peak of 34 Sept 18th. At Hickling 1-5 July 26th-Sept 9th. Cley had peaks of 17 July 21st/24th and 23 Aug 8th/9th with latish birds Oct 3rd and Nov 1st. Titchwell had peaks of 10 July 28th and 18 Aug 14th

while at Lynn Point there were 8 Aug 9th increasing to 35 Aug 23rd. Small numbers at King's Lynn BF July 31st-Sept 1st while a very late bird Welney Nov 16th.

Purple Sandpiper: Heacham-Hunstanton is main stronghold and monthly peaks here were Jan 41, Feb 63, March 44, April 40, Nov 22 and Dec 28. Substantial numbers also at Walcott where monthly totals were Jan 20, Feb 25, March 22, April 25, Nov 21 and Dec 21.

Counts of 16 Gorleston-Hopton Jan 26th and 14 Yarmouth Feb 14th were also of note while others reported at Winterton, Happisburgh, West Runton, Salthouse, Scolt and Titchwell.

May individuals at Heacham 12th, Cley 20th/21st and Walcott 21st. Early returning birds at Cley Aug 2nd onwards, Winterton Aug 6th and Titchwell Aug 7th. A very unusual inland occurrence at Salhouse Broad during severe weather Jan 14th.

Dunlin: Peak counts on the Wash at Snettisham: Jan 5,500, Feb 6,100, May 850 and Oct 14,635. A westerly movement of 4,440 off Paston Nov 21st.

Broad-billed Sandpiper: Breydon May 4th (PRA) and Hickling May 10th (DJH SL) with a further bird at Breydon June 21st (PRA).

Ruff: No evidence of successful nesting. Winter flocks at Berney 40 Dec 28th, Stracey Arms 27 Dec 26th, Hickling-Potter Heigham 32 Feb 25th and 60 March 21st and Holkham 19 Jan 2nd-7th.

A pronounced spring movement during April with the larger groups at Hickling-Potter Heigham 90 April 7th and 116 April 15th; Cley 85 April 15th, 150 April 16th/17th and still 120 April 23rd; Welney 152 April 24th and 244 April 25th but numbers quickly reducing over the following week. Much lecking activity during the height of this passage and often 20 birds or more involved at a time.

A typical widespread autumn passage with peaks of 100 Cley July 5th, 80 Holkham Aug 26th on the flooded grassland, up to 50 Welney Sept to Nov and 40 Berney Oct with 23 Nov 5th.

Jack Snipe: Reported from 21 sites up to April 20th (Holme) and from Oct 11th (2 Blakeney Point). Largest groups at Buckenham (5 Jan 2nd), Strumpshaw (5 Nov 10th) and Breydon (4 Nov 1st).

Snipe: Drumming birds at Norwich 2, Strumpshaw 17, Dilham, Hickling, How Hill 5, Belaugh 5, Catfield 2, Lopham Fen 4, Royden Fen, Flitcham, West Acre 3, East Walton 2, Cockley Cley, Foulden, Boughton 4 and Welney 91.

Several sizeable autumn/winter concentrations doubtless assisted by the mild wet winter: Hardley Flood 100 Sept 13th; Cantley 160 Sept 21st and in Dec Buckenham/Cantley 1,000, Berney 800, Halvergate 560 and Welney 400.

Great Snipe: Blakeney Point, one probably juvenile Aug 25th to 27th (JBK BB *et al*). The first county record since 1976 when 4 arrived. At one time considered a regular autumn arrival. In 1899 for example 8 shot in Norfolk between Sept 14th and 27th (*per* B. B. Riviere).

Woodcock: The few reports received only hint at the widespread breeding distribution. 26 roding birds were at 14 sites: Beachamwell, Boughton 3, Drymere 7, Foulden Common, Hickling, Hillington, Hockham, Holme Hale, Ranworth 4, Roydon 4, Shingham, Surlingham/Rockland and Wayland Wood.

Only concentrations were of 8 at How Hill (March) and 7 at Pentney (April).

Black-tailed Godwit: Spring floods and a cool wet breeding season disrupted nesting attempts again at Welney. Five pairs attempted breeding but only one chick reached the flying stage.

Small numbers present in the winter with Jan records coming from Breydon 9th,

Snettisham (up to 6), Ouse Mouth 70 on 31st and Welney 40 on 29th. In Dec 2-3 Berney, Breydon and Welney though 38 lingered at Titchwell.

Spring passage peaked with counts at Welney (Icelandic birds) of 242 March 11th/12th and 250 April 6th with smaller counts from Hickling 9 May 16th, Cley 22 April 8th, Titchwell 13 (May) and Snettisham 25 March 4th.

Post-breeding counts included 18 Hickling July 19th, 32 Cley Aug 16th, 160 Brancaster July 26th at high tide roost, Titchwell 70 in July and 183 in Aug. Passage continued into Oct when there were 16 Breydon 16th, 39 Titchwell, 56 Holme 20th and 38 Welney 6th.

A late flock of up to 105 remained at Titchwell during Nov.

Bar-tailed Godwit: Peak count on the Wash at Snettisham: 11,800 Jan 4th prior to big freeze. At Scolt 400 Jan 25th, 500 Feb 15th and March 15th.

Inland migrants at Hardley Flood May 7th, Pentney GP April 25th and Welney March 4th, 2 April 17th and May 7th-10th.

Out-of-season red-plumaged birds at Blakeney Jan 3rd, Titchwell Jan 31st, Wells Feb 8th and Heacham Jan-March (2 on Jan 8th).

Whimbrel: Extreme dates April 16th (Welney) and Nov 5th (Hunstanton) followed by an exceptional report of 2 Snettisham Dec 2nd. Fairly light spring passage including 29 north-east at Heacham April 27th and 2 inland records: 18 April 30th and 13 May 12th at Stow Bridge.

Sizeable autumn flocks included Cley 89 July 26th, Winterton 65 Aug 2nd and Holme 97 Aug 2nd.

Curlew: On Wash at Snettisham up to 1,800 Aug 15th. Three pairs displaying in north-west Norfolk, but no figures available for Brecks.

Spotted Redshank: Winter records from Morston Jan 4th and Berney/Breydon (2-3) Dec. Widely spread during spring when 7 Burgh Castle April 28th, 2 Hardley Flood May 9th, 8 Hickling April 26th/28th and 8 May 10th, 30 Cley April 18th with 8-10 May 1st-7th, 3 King's Lynn BF April 21st and 11 Welney April 29th and up to 3 May.

A few June birds (1-4) at Breydon, Hickling, Pentney GP and Welney. First juvenile of the year at Breydon Aug 8th followed by 13 arrivals Aug 9th with others at Hickling where 7 July 8th, Elsing 10 Sept 5th on flooded meadows, Cley 30 July 31st and 12 Aug 16th, Holme 12 Sept 14th, Snettisham 14 Sept 30th, Lynn Point 8 Aug 9th, Pentney GP 8 Sept 13th and Welney 5 Sept. Small numbers also at Dickleburgh Moor, UEA Broad Earlham, Titchwell, King's Lynn BF and Tottenhill GP.

Redshank: Peak Wash counts at Snettisham were 1,690 Aug 15th and 2,500 Sept 13th. Inland breeding pairs at West Acre, Castle Acre, King's Lynn BF, Tottenhill GP, Stow Bridge and Welney (48 pairs).

Marsh Sandpiper: The ninth county record, a moulting adult at Cley July 22nd-Aug 2nd (DA *et al*). This bird appeared at Titchwell Aug 3rd and near Boston, Lincs, Aug 8th-15th.

Greenshank: First spring migrant at King's Lynn BF April 13th heralding usual light spring movement though a count of 16 Snettisham April 25th. Also 8 Breydon May 2nd, 6 Hardley Flood and 5 Welney both May 9th and 5 Hickling May 17th.

More widespread in autumn and last recorded Titchwell Nov 14th. Major counts: 28 Breydon July 17th, 29 Burnham Norton July 25th, 26 Holme Aug 31st, 24 Snettisham Aug and 28 Titchwell Oct 22nd.

Green Sandpiper: Noted at a minimum of 18 sites in winter (Jan, Feb and Dec), mostly singles. Typical light spring passage with no more than 2 birds at any one site.

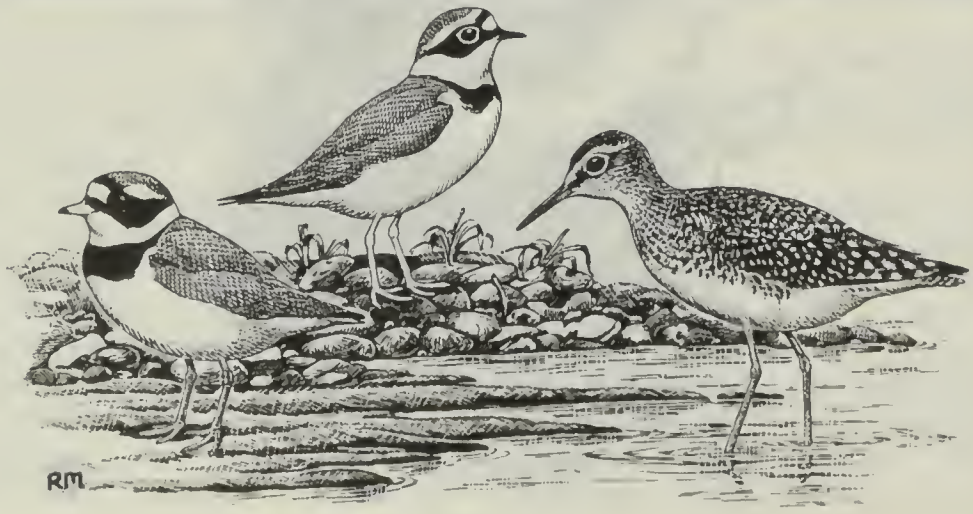
Prominent on return passage when 14 Wissington BF July 17th, 25 Cantley July 19th, 12 Hickling July 19th, 13 King's Lynn BF July 31st and 10 Tottenhill GP (July-Aug). August counts included 13 Colney/Bawburgh 12th, 14 Holme 19th and 10 Pentney GP 30th. In Sept 15 Cley on 3rd.

Wood Sandpiper: Well represented on both passages. An early start to spring movement saw April birds at Welney 25th-27th, Hickling (2) 28th and Cley 29th.

A strong May arrival when birds at Hickling 4th-23rd (maximum 7), Surlingham 3rd/4th and 24th, Strumpshaw 18th, Hardley Flood 8th-18th (maximum 7), Bawburgh 31st, Colney GP 1st and 31st, Cley 7th-29th (maximum 5), Holkham 11th-25th (maximum 3), Holme 24th, West Acre 25th, Pentney GP 6th/7th and Welney 1st-24th (maximum 3).

June records of singles at West Acre 2nd, Welney 12th and Hickling 18th/21st (2).

A prominent and widespread return passage commencing in July when recorded at Berney (2) July 21st/24th, Cantley BF 19th-26th (maximum 8 on 24th), Hickling (4) 19th, Surlingham 24th-27th, Cley 2nd-30th (maximum 10 on 24th/25th), Holkham



19th, King's Lynn BF 22nd-26th (maximum 4), Wissington BF (5) 23rd, Wretham 25th and Welney 18th-26th (maximum 7 on 21st).

During Aug observed at Yarmouth 25th, Cantley BF (2) 21st, Surlingham 15th, Whitlingham 9 on 28th/29th, Hickling 10th, 27th/29th (maximum 12), Horsey 4 on 28th, Cley 5 on 1st, one on 8th and 6 21st/23rd, Salthouse 21st, Holkham 7 on 10th, Holme 16th/17th and 28th, South Creake 14th, Lynn Point 15th and 2 on 30th, King's Lynn BF 1st-31st (maximum 6), Wissington BF 4 on 30th, Pentney GP 15th-22nd and Welney 2 on 2nd and 7 on 29th/30th.

Still obvious in Sept when noted at Hickling (maximum 4), Surlingham 16th, Cantley 16th, Dickleburgh Moor 5 on 1st and 2 on 7th, Cley 10 1st-6th, Holkham 12th/13th (maximum 5) and 22nd, Titchwell 8th, Holme 3rd, Flitcham 3rd/4th, King's Lynn BF 1st-8th (maximum 8) and Welney 3 on 2nd and 9 on 15th.

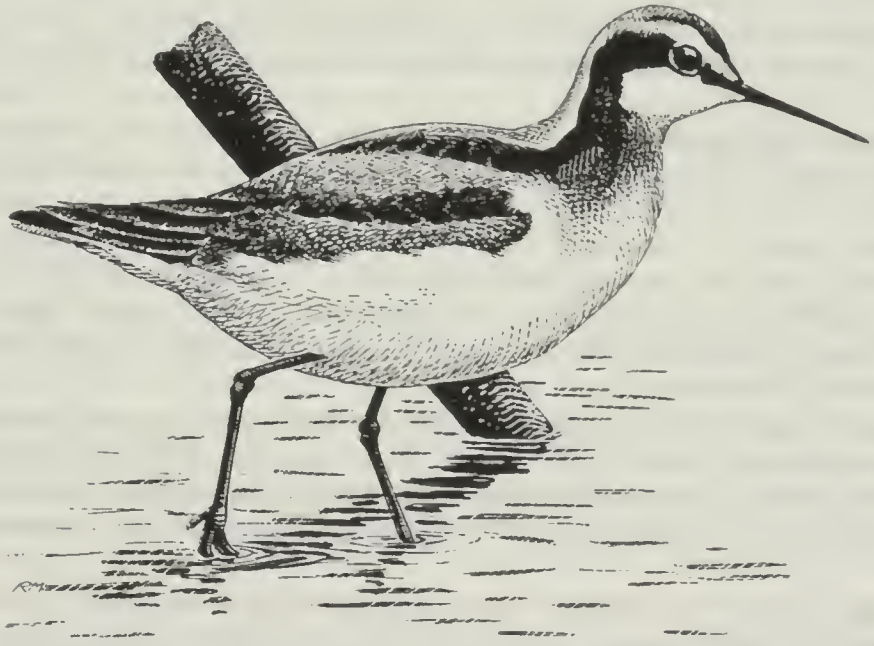
Stragglers in Oct at Cley 14th, Dickleburgh Moor 21st/23rd and Berney 26th.

Common Sandpiper: An unspectacular spring passage as usual. Several noteworthy gatherings on return passage which peaked in late Aug. Largest groups: 62 Breydon Aug 29th, 22 Hickling Aug 29th, 20 Strumpshaw Aug 25th, 21 Salthouse Aug 30th, 15 Morston Aug 15th, 15 Titchwell Sept 7th, 35 Lynn Point Aug 24th and still 30 Sept 14th, 22 King's Lynn BF July 26th and 18 Wissington BF Aug 14th with 16 still present Aug 29th.

Latish bird Pentney GP Nov 1st followed by a wintering bird at Cley Dec 1st/27th.

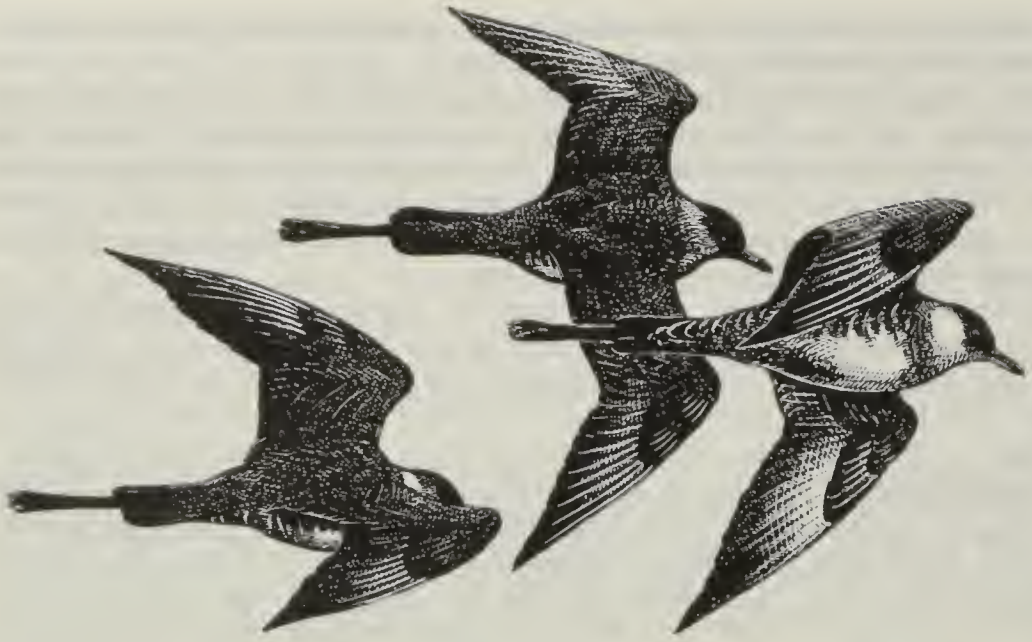
Turnstone: Largest Wash counts at Snettisham: 335 Jan 4th, 431 Aug 15th. Other assemblies at Scolt where 170 Jan and 150 Feb and Brancaster where 150 Sept and 180-200 Dec.

Wilson's Phalarope: Cley a summer plumaged female May 9th-12th (SJMG DJH *et al*). Winter plumaged adults at Breydon Aug 16th (PRA KRD) and at Snettisham Aug 28th-Sept 3rd (DL JEC).



Red-necked Phalarope: Slightly more records than in recent years: Breydon July 17th, Cley female June 8th-11th and juvenile Aug 27th-Sept 6th, Titchwell juvenile Aug 27th, Holme male July 2nd and a moulting female Snettisham July 27th-Aug 2nd.

Grey Phalarope: A winter record of one beneath the new Breydon bridge Jan 20th



whilst a single flew west at Cley Nov 20th.

Two records following the mid-Oct hurricane which just brushed Norfolk: One near the former Wisbech SF Oct 17th and another filmed on floodwater near Hockwold Oct 18th-20th.

Pomarine Skua: Autumn passage observed between Aug 15th (Cley-Blakeney Point) and Dec 1st (Holme). Only sizeable movement was of 18 off Cley during strong northerly winds Aug 24th. An inland immature chasing wildfowl and gulls at Surlingham Church Marsh Oct 3rd.

An autumn total of 86 individuals recorded as follows: Aug 45, Sept 23, Oct 12, Nov 5 and Dec one. A complete contrast to most years when sightings peak in Oct or even Nov.

Arctic Skua: May sightings from Waxham 24th, Cley 16th/17th, Blakeney Point 3rd, 17th and 25th, Scolt 20th, Holme 2 21st, Hunstanton 12th and Wootton Marsh 3 on 12th.

Autumn passage commenced July 19th (Holme). Largest movements: 121 east Paston Aug 24th, 53 Cley Aug 23rd followed by 73 Aug 24th and 40 Sept 13th, 51 Holme Aug 20th and 53 Aug 27th, 56 Hunstanton Aug 24th and 37 Aug 27th.

Late birds at Snettisham Dec 3rd and 17th, California Dec 5th and Heacham sitting on beach Dec 20th.

Long-tailed Skua: All records given. Holkham Bay adult Aug 5th (JRMcC), Lynn Point juvenile Aug 24th (NB), Waxham adult Aug 24th (BWJ), Sheringham adult Aug 25th (SB BB), Cley/Blakeney Point 2 juveniles Aug 25th (NB MAB), juvenile Aug 27th (CK) and 2 adults Sept 13th (PDK) and Holkham Bay juvenile Sept 26th (AB).

Great Skua: The year opened with an individual scavenging the beaches at Snettisham-Heacham from Jan 2nd-19th when found dead. Another at Cley Jan 3rd.

An unusual spring occurrence at Blakeney Point May 3rd. Noted in autumn from July 20th (2) Cley followed by 25 Sept 26th there and 35 Aug 27th. Other movements: 24 Holkham Sept 26th, 25 Holme Aug 20th and 25 Aug 27th and 73 Hunstanton Sept 26th. Latest record Holme Dec 1st.

Mediterranean Gull: Breydon (1st summer) May 12th-17th with 1-3 May 31st-July 5th. Adult Aug 17th and Dec 20th together with 1st winter Nov 4th. Yarmouth: Single adults in Jan and Feb with 3 in March (displaying on 19th), 2 in April until 5th, adult June 14th-23rd, 3 from July 23rd, 4 in early Aug, 5 on 13th, 6 on 17th-23rd; singles most of Sept/Oct but 2 (2nd winter) Sept 15th/16th, 3 in Nov and one in Dec.

Hickling (1st summer) May 11th and adult Aug 2nd; Eccles 2 (1st winter) Oct 29th; Paston adult Nov 15th and Overstrand (2nd winter) Sept 20th and Oct 24th; Strumpshaw Tip adult Feb 14th; Hellesdon GC sub-adult March 27th.

Cley/Salthouse/Weybourne 1st winter on several dates in April, May and into June with 3 birds June 21st, an adult first seen Aug 15th stayed most of Sept, also adults Oct 16th/17th, 30th and Nov 21st. Blakeney Point immature May 25th-June 4th in gullery; Wells (2nd winter) Sept 20th; Scolt 2 May 10th and 2nd winter Sept 1st; Brancaster Oct 20th; Titchwell 1st winter Nov 28th; Holme 2 Aug 30th; Hunstanton 1st winter April 22nd; Heacham adult July 2nd, 1st summer April 17th/29th, 2 (adult winter/second winter) Oct 20th and 2nd winter Dec 16th; Snettisham adult March 16th/17th, 26th and July 17th and 24th; King's Lynn 1st winter since Nov 1986 till March 28th and Welney 1st winter Feb 22nd and March 15th.

Little Gull: Several coastal records Jan-March from Paston, Cley, Titchwell and especially Hunstanton where maximum counts were 30 Feb 24th and 18 March 22nd.

Many breeding plumaged adults passed through during warm weather in April. Counts included 25 Colney GP April 25th, 5 Hickling April 17th, 7 Rockland Broad April 17th, 16 Bacton April 17th, 10 Titchwell April 26th and a total of 176 passed through Welney April 17th-26th peaking at 113 April 22nd. Also 11 Hunstanton May 13th.

A few immatures summered at Cley (8), Hickling (3) and Holme (2).

Oct/Nov produced expected offshore movements. Among selected counts: Waxham 45 Oct 24th, Paston 54 Oct 3rd and 169 Nov 1st, Cley/Blakeney Point 50 Oct 24th and 50 Nov 1st; Holkham Bay/Wells 50 Nov 1st, Holme 57 Oct 3rd, 130 Nov 1st and 30 Nov 4th and Hunstanton 26 Oct 12th and 19 Nov 20th.

Inland records are rather infrequent in autumn so the following hurricane records are of interest: Ranworth 1st winter Oct 17th, Narford Lake 3 Oct 16th and Welney 5 Oct 16th and single Oct 23rd. Observations continued into Dec when a single Yarmouth 5th and 20 Thornham Point 19th.

1986: Additional record of 27 Weybourne Dec 10th.

Sabine's Gull: The increase in records can be attributed to the mid-Oct hurricane which struck southern Britain on the night of 15th/16th Oct. An early adult at Cley July 28th (JB) followed by another adult Holme Aug 29th (PRC). On Oct 16th 2 juveniles were blown north up the Ouse Washes at Welney (JBK). 2 adults frequented flooded fields at Dickleburgh Moor from Oct 21st/22nd (MA MS) one remaining to Oct 23rd. An adult at Cley Oct 22nd (FAW) and another adult Lynn Point Oct 25th (NARVOS) while a late bird was off Hunstanton Nov 2nd (MW).

Note: Two previously published winter records (22nd Dec 1979 and 1st Jan 1980) now considered unacceptable after review by County Records Committee.

Black-headed Gull: Albinos reported from Welney (Jan), King's Lynn (Jan) and Cley/Salthouse (March/April). Breeding pairs at Blakeney Point (8-900), Warham Saltings (1,000), Scolt (350), Snettisham (604) and Wissington BF (200).

Slender-billed Gull: A pair at Cley/Blakeney harbour May 12th-15th (MG BJC *et al*). Observed mating on the latter date. First county record. See page 101.

Common Gull: Scolt: 2 pairs summered, but no successful breeding.

Lesser Black-backed Gull: Breeding pairs at Blakeney Point (5) and Warham saltmarsh (3+).

Herring Gull: Breeding pairs at Blakeney Point (14) and Warham saltmarsh (5). A yellow-legged bird at Cley April 25th.

Iceland Gull: A first-winter Strumpshaw Tip Feb 14th (RSPB), an adult Cley March 9th (TC JJ) and an immature described as first-winter or second winter at Weybourne, Salthouse, Cley, Blakeney harbour and Holkham Bay Nov 22nd (PC TLD BM); 2 birds possibly involved.

Glaucous Gull: Fewer than normal, especially during very mild second winter period. Coastal records from Yarmouth Nov 22nd and Dec 30th; Breydon immature Feb 13th; Cley/Salthouse/Blakeney Point adult in both winter periods returning Aug 31st, a 1st winter April 4th-29th and again May 17th; Brancaster third winter March 9th; Titchwell adult Dec 15th; Hunstanton/Holme adult Jan 13th and 17th, Feb 1st, 2 adults Feb 2nd and 1st winter Jan 11th; Heacham 2nd winter March 29th; Snettisham Jan 31st and Oct 19th.

Several inland sightings: Strumpshaw Tip 1st winter Jan 25th-27th and Feb 16th and Nov 26th onwards; Rockland Broad 2nd year Feb 25th; Colney GP 1st winter Jan 31st; Frettenham sub-adult April 12th; Attlebridge adult Feb 19th; Hempton Tip immature Feb 8th; Wereham Tip 1st winter Jan 6th-9th, Feb 19th-22nd, 3rd winter March 22nd and 1st winter Nov 20th.

A Glaucous × Herring Gull 1st winter hybrid Wereham Tip March 20th-31st.

Great Black-backed Gull: A few wintering individuals on Ouse Washes at Welney specialise in catching injured or sick ducks, flying through flocks of waterfowl to disturb them and quickly selecting any individuals which are knocked to the ground or into water.

Kittiwake: Three inland reports: Rockland Broad 1st winter March 26th, Narford adult May 16th and Welney 1st winter Oct 16th. Flock of 200 resting on River Ouse north of King's Lynn May 3rd during strong north-east winds.

Caspian Tern: Hickling, intermittently between May 23rd and July 5th (DA SL). Breydon, presumably the same bird as above June 12th and 27th/28th with 2 July 4th-7th (PRA AD). Cley adult Aug 20th (GMC GJW).

Sandwich Tern: Extreme dates March 22nd and Nov 8th (both Blakeney Point). At Scolt 2,900 pairs reared 3,200 young to flying stage. At Blakeney Point 450-500 pairs bred.

Inland sightings at UEA Broad Earlham 3 Aug 23rd; Pentney GP 4 Aug 27th-29th coinciding with northerly gales with 2 until Sept 2nd and one until 4th and single Welney Oct 16th.

Roseate Tern: Only recorded at Blakeney Point May 28th-30th (NT) and Scolt May 8th (NCC).

Common Tern: Extreme dates April 11th (Holme and Scolt) and Oct 26th (Hickling). A county total of 846 breeding pairs, major sites being Breydon 63 with 101 young fledged, Ranworth 35 and 45 young fledged, Hardley Flood 27, Blakeney Point 300, Scolt 208 but few young reared and Snettisham 84 with 64 young fledged.

Arctic Tern: Extreme dates April 20th (Titchwell) and Oct 27th (Holkham). A light passage developed during first week of May when small numbers at several inland localities coinciding with strong north/north-west winds. Highest counts: 31 at Holt on 2nd, 22 Lynn Point on 3rd, 31 Salthouse on 4th, 21 Breydon on 5th and 11 Welney on 6th and 12th.

Autumn numbers mostly small apart from Aug 25th in northerly gale conditions with heavy rain when 82 Paston, 20 Weybourne and 250 Holkham Bay.

Six pairs bred Blakeney Point and a single unsuccessful pair at Scolt where there was also a mixed pair Arctic × Common Tern; two chicks hatched but disappeared.

Little Tern: Extreme dates April 18th (Scolt) and Oct 3rd (Holme). A pleasing increase to 536 breeding pairs though success varied from colony to colony. At Yarmouth 70 pairs reared 96 chicks, but 42 pairs Titchwell reared virtually none. Early autumn assembly at Lynn Point peaked at 140 July 20th; at Snettisham 95 Aug 17th. An inland single Colney GP May 10th.

Whiskered Tern: Pentney GP an adult June 30th-July 1st (RP AC *et al*) departed high at 2045 hours. The first county record since 1971.

Black Tern: Early spring passage commenced April 17th (Cley, Hickling, Rockland, Welney) with probably 3 or 4 main waves of migrants into late May. Peak counts on spring migration included 16 Welney April 24th followed by 43 April 28th, 27 Snettisham between April 25th and 28th, 15 Breydon May 9th and 15 Rockland May 10th.

Autumn passage more coastal orientated peaking in the northerly gale and rain of late Aug. Main Aug movements: 21 Walcott, 16 Paston, 14 Weybourne and 12 Cley all on 25th; 21 Sheringham, 9 Blakeney Point and 13 Lynn Point all on 26th. Last Cley Oct 23rd.

White-winged Black Tern: Hickling May 10th (AC DJH) followed by another adult at Methwold Hythe June 13th (REN AJR).

Guillemot: Inland: Welney Dec 10th.

Razorbill: Inland: Massingham a road casualty Jan 5th.

Black Guillemot: Cley July 18th, Weybourne Aug 17th, Holme Sept 12th, Salthouse Sept 29th and Cley Oct 22nd.

Little Auk: Singles on 9 dates Jan 3rd to 20th in inshore waters.

Between Oct 20th and Dec 13th reported almost daily on coast following an influx into the North Sea caused by severe storms. Onshore winds locally brought the most impressive totals on Nov 9th (43 Wells and 10 Cley) and Nov 21st (50 Cley and 25 Paston).

Wrecked birds in Nov appeared at Wells Boating Lake (subsequently killed by a Heron), Kirstead (taken to Norwich Castle Museum), Colkirk and Langley Abbey. Another was spotted flying over the main street in Holt.

Puffin: 26 North coast records Jan, May and Aug-Dec. Largest party 4.

Collared Dove: Only concentrations reported: Wroxham Station (90 Sept) and King's Lynn Docks (120 Feb, 160 March and 280 Nov).

Turtle Dove: Spring arrival April 9th (Weeting), but no others until April 18th (Brundall) followed by others on 24th at Hickling, Snettisham, Titchwell and Wootton. Hunstanton 84 south April 30th, Heacham 46 south May 9th and Snettisham 470 passed through May 14th. Early autumn assembly of 68 Wroxham Station Sept 2nd. Last (West Beckham) Oct 3rd.

Ring-necked Parakeet: Singles (apart from 2 at How Hill) at Bradwell, Breydon, Brundall, East Tuddenham, Lopham Fen, Potter Heigham, Sparham, Welney and Winterton.

Barn Owl: Recorded at 145 localities.

Little Owl: Recorded at 54 sites.

Long-eared Owl: Breeding recorded at 3 sites. Autumn migrants included Blakeney Point and Cley arrivals Oct 19th and 20th, Holme Oct 20th, Blakeney Point Oct 27th and Nov 3rd and Paston Nov 21st.

Winter roosts occupied at 2 Fenland sites (8 in Jan and 3 in March respectively); King's Lynn Hospital Jan 13th-Feb 5th, New Buckenham up to 15 Feb 8th-March 21st and Hethersett 6 till third week Jan.

Short-eared Owl: At beginning of year only concentrations 4 along Lower Bure Jan 31st and 7 at Haddiscoe Feb 16th. No breeding confirmation.

During autumn singles in off sea at Salthouse Oct 26th and 27th, Waxham Oct 29th and Nov 3rd when one also arrived Blakeney Point.

Nightjar: Churring birds at Bridgham Heath (4), Cats Bottom, Cawston Heath, Drymere (6), Ickburgh, Kelling Heath (3), Leziate, Roydon Common (4), Salthouse Heath (4), Sandringham, Winterton and Wolferton (2). Doubtless present at other suitable Breck localities.

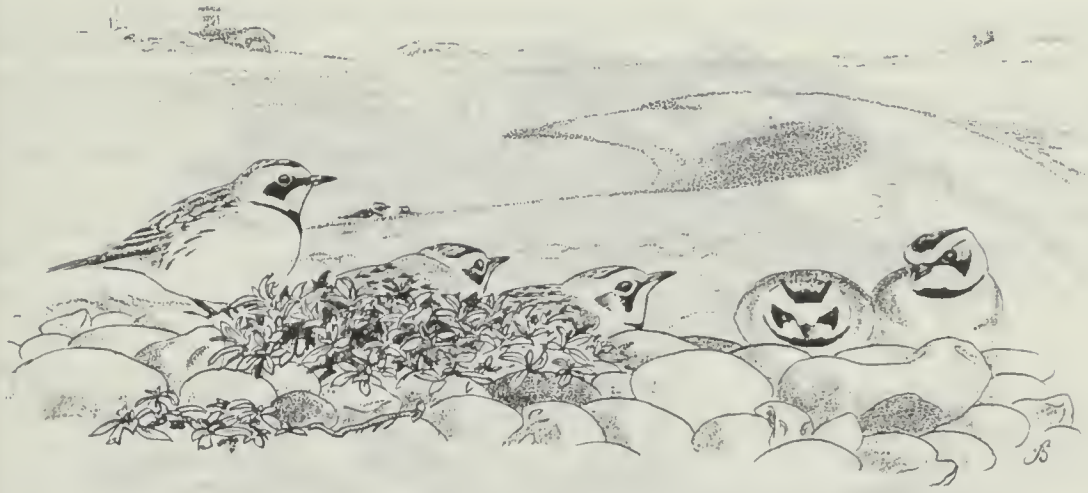
Swift: Earliest record Pentney GP April 20th. Concentrations of 3,500 Brundall (River Yare) May 12th and 2,500 over rape harvester Burnham Market Aug 10th. Late individuals Snettisham Oct 22nd and Horsey Oct 31st.

Alpine Swift: Cley April 18th (CJS) and probably same bird Wiveton April 20th (PG).

Hoopoe: Blakeney Point April 18th (JR), Welney April 26th (WT), Snettisham May 11th-13th (many observers) and Old Catton Oct 24th (JRA).

Wryneck: Several spring records: Hempnall April 18th-20th, Norwich April 19th, Burnham Overy April 24th, Holkham Meals April 27th, Potter Heigham May 6th and 17th, King's Lynn May 20th-23rd, Blakeney Point May 23rd, Hunstanton GC (2) May 23rd and Holme May 23rd/24th.

In autumn singles East Wretham Aug 10th and Watton Aug 23rd, several arrivals by 25th followed by major fall Aug 26th round whole coast including 7 Weybourne,



15 Blakeney Point, 25 Wells (East Hills), 11 Holkham Meals and 14 Holme. Largest numbers since 1977. The birds gradually dispersed over the next few days with subsequent inland records up to Sept 10th from Buxton, Corpusty, East Dereham, Erpingham, Hellesdon, Horstead, Hunworth, Ickburgh, Norwich and Taverham. Late migrants at Holme Oct 11th and 29th.

Woodlark: A migrant at Paston April 19th. In whole of Brecks total of 43 singing males (compared with 48 in 1986) including 23 in Norfolk.

Shorelark: Recorded at following coastal localities: Gorleston 2 Jan 10th-12th and 4 Jan 18th-22nd, Yarmouth Nov 22nd, Winterton 4 Feb 20th-April 12th with one remaining until 19th when singing also Nov 16th, Cromer Oct 16th-18th, Salthouse April 19th and Oct 11th, Cley Oct 10th/11th, Blakeney Point up to 25 in early months of year with last 9 May 5th; 7 in late Oct but only 4 in Dec, Thornham Point 2 April 24th-26th with 2 again from Nov 12th, 4 from Dec 5th and 5 from Dec 24th, Holme 2 March 31st, Heacham Oct 23rd and Snettisham 1-2 Nov 7th/8th.

Sand Martin: Earliest record Cley March 26th. An albino (except for dusky wingtips) Colney GP June 27th and another at Surlingham July 7th. Larger numbers present than in previous years with counts of 3,000 at roost Strumpshaw mid-July, 800 Welney July 31st and 550 west Paston Aug 3rd. Very late migrants Happisburgh Nov 8th and Waxham (2) Nov 12th.

Swallow: An almost white bird Holme Sept 5th-9th. In late Nov 5 at Cley 21st, single at Wells 22nd with latest at Yarmouth on 23rd and at Griston (2) on 26th.

Red-rumped Swallow: An unprecedented total of 5 records: Cley/Wiveton/Blakeney April 8th-12th (ETM *et al*), Happisburgh Nov 11th (CRW *et al*) and 3 Winterton Nov 12th (BWJ). See page 98.

House Martin: Earliest: Lound March 29th and Holme March 30th. An albino at Paston Sept 5th. Latest Nov records: Cley 22nd, Holkham 23rd and Norwich (2) 27th.

Richard's Pipit: One winter record: Holkham Jan 3rd-10th (PC *et al*). Total of 13 autumn migrants: Winterton Oct 24th/25th, Paston Oct 3rd, Blakeney Point Oct 3rd, Wells (East Hills) Oct 4th, Holkham Sept 20th, Oct 2nd and 2 Oct 4th, Scolt Head Oct 4th, Titchwell Oct 13th, Snettisham Oct 6th-22nd and inland 2 Potter Heigham Oct 14th (JRW).

Tawny Pipit: Waxham April 23rd/24th (TRB *et al*), Wells (East Hills) May 26th (JMcC), Cley June 2nd (ME PG) and June 24th/25th (NB PJH *et al*) and Blakeney Point Sept 1st (SCJ).

Olive-backed Pipit: Blakeney Point Oct 2nd (DA SJMG) and Sheringham Nov 7th (RAJF RWS). The fourth and fifth county records.

Tree Pipit: A late migrant Holme Nov 1st.

Rock Pipit: Singles of Scandinavian race identified at Winterton March 18th, Burnham Overy March 21st and Breydon April 4th.

Water Pipit: In contrast to recent years not regularly reported at any one locality: Blakeney Point Nov 14th, Breydon March 14th and 22nd, Buckenham Oct 28th, Burnham Norton March 13th, Cley March 8th and 26th-30th, Hickling April 18th-24th and 4 Oct 11th-20th, Strumpshaw 2 March 29th and 2 April 5th/6th, Surlingham Church Marsh Feb 17th, March 5th and 5 April 2nd, Titchwell Jan 8th and Wells April 5th.

Yellow Wagtail: First noted Welney April 2nd (where 60 pairs bred). Main spring passage April 18th to May 2nd with concentrations of 250 Snettisham April 21st, 320 Cley (Eye Field) April 22nd and 190 Hunstanton cliff-top and bowling greens April 27th. Aug roost of 40-50 Hardley Flood. Late migrants at King's Lynn BF Nov 2nd and a female Weybourne Nov 8th considered by observers to be of one of the eastern races.

Syke's Wagtail: One showing the characters of this race Pentney GP April 20th (JBK).

Blue-headed Wagtail: Records received of over 40 birds April 18th to June 11th with maximum of 3 Horsey April 25th.

Grey-headed Wagtail: A total of 9 spring records: Horsey May 1st and 2 May 16th, Salthouse April 27th, 2 May 14th and one May 15th, Cley 2 May 13th and an unusual inland occurrence at Colney GP May 18th.

Also one showing characters of Grey-headed or Ashy-headed at Burgh Castle May 19th.

Grey Wagtail: Breeding records at Brandon Bridge, Buckenham Mill (2 broods) and Lyng Bridges. Also pairs present in summer at King's Lynn and Narborough Mill.

Pied Wagtail: A newly recorded roost at Whitlingham Marshes Thorpe St. Andrew where up to 260 in Oct. Additional roosts: 80 Surlingham Church Marsh Nov/Dec, 75 Rushmeadow Oct/Nov and 120 King's Lynn BF Aug.

White Wagtail: Larger numbers than normal recorded on spring passage March 25th-April 28th including maxima of 9 Weybourne April 6th, 20-30 Cley April 18th-

20th and 10 Heacham April 26th. Also singles Weybourne May 23rd and Aug 29th and Titchwell Oct 4th.

Waxwing: Following an influx into the county in Dec 1986 birds continued arriving with a total of over 90 in Jan at 31 localities. Waxwings tend to wander from place to place when food supplies become exhausted and accordingly the number in total may have been somewhat less. Records included 15 Tunstead Jan 21st, 12 Sheringham 25th-28th, 8 Surlingham Church Marsh 21st, 6-7 Cley up to 4th and up to 5 well watched birds in Norwich (Stafford Street) up to 29th. Subsequently 2 Holme Feb 10th and 2 Sprowston March 22nd-27th.

Only a single record in second-winter period: Wells Nov 15th/16th.

Black-bellied Dipper: Hunworth (River Glaven) March 13th (CS).

Wren: At Filby 19 discovered frozen to death in a hollow apple tree Jan 24th. Up to 14 roosting in a House Martin's nest at Langley and a similar 1986 record of up to 28 occupying 2 nests on observer's bungalow at Brundall until April 22nd.

Thrush Nightingale: Holkham Meals, a singing male May 24th (PC *et al*). Unfortunately this bird sang in a thick clump of privet and remained hidden from a frustrated audience of birdwatchers! Second county record.

Nightingale: Holme a coastal migrant April 22nd/23rd with 2 present following day.

Bluethroat: Another excellent May for this species although not as many recorded as in the 1985 fall. Interestingly, nearly half of the birds seen were females in contrast to 1985 when majority were males — possibly due to the later dates involved. Majority at Blakeney Point (3 on 22nd, 11 on 23rd and 6 on 24th including 2 additional arrivals with last on 26th) and at Holme (one on 19th, 4 on 22nd, 5 on 23rd/24th, 3 on 25th and last on 27th). Elsewhere singles at Horsey 24th, Paston 24th and 26th, Weybourne 23rd/24th, Salthouse 24th-26th, Cley 23rd, Blakeney Bank 24th, Stiffkey 29th/30th and Holkham 24th.

Surprising changes in the pattern of Bluethroat passage are most likely to be climatic. Blocking anticyclones in spring (bringing Fenno-Scandian migrants) are apparently occurring more frequently (including 1970, 1985 and 1987). During these three years a total of 90 spring-time Bluethroats were reported in Norfolk. Although spring numbers have increased dramatically there is only a single report of an autumn Bluethroat in the county after 1979 (on 26th October 1985) despite greatly increased observer cover and awareness. A likely factor behind this pattern is a lack of easterlies during the main southwards passage of Scandinavian Bluethroats in late Aug and early Sept.

Autumn Bluethroat passage in Britain now tends to occur later, from mid-Sept onwards and several weeks after the main Scandinavian movement. Source of these later migrants is likely to be Russia and Siberia judging from the species which accompany them nowadays. In addition, the decline of autumn Bluethroats here coincides with serious Sahelian droughts which have badly affected other wintering Palearctic migrants.

Black Redstart: Spring passage commenced March 25th (Wells) with an influx April 5th when 3 Horsey, 4 Happisburgh, 5 Paston, 4 Holme and 5 Heacham. Breeding noted at Cantley BF, King's Lynn BF, King's Lynn Docks, North Walsham and Yarmouth/Gorleston (2 pairs) where another 5 singing males. Norwich and Thetford also attracted apparently unattached singing males in breeding season.

In autumn noticeable fall Oct 19th/20th when 10 Blakeney Point, 6 Wells Lifeboat Station and 6 Holme. One at Heacham until Dec 1st and another Horsey Dec 24th.

Whinchat: Recorded April 27th (Shingham) to Nov 22nd (Heacham), a very late date. Bred in Brecks at Tommy's Belt and a male in song Smoker's Hole in June.

Stonechat: As in 1986 6 breeding pairs along East Coast.

Wheatear: Earliest Breydon March 12th. Two pairs bred at Paston where also latest record: Nov 1st.

Ring Ouzel: Spring passage March 28th-May 30th. Peak numbers April 17th when 7 at Kelling and Weybourne and 5 at Cley and Holkham Meals. Mainly seen at coastal localities with additional records from Blackborough, Burgh Castle, Felbrigg, Foster's End GP, Hickling, How Hill, North Creake, Northrepps, Norwich, Potter Heigham and Welney.

A noticeable increase in autumn observations compared with recent years; total of nearly 50 migrants Sept 17th-Nov 14th. Majority at end Oct/early Nov with up to 3 together. Inland sitings at North Walsham, Norwich and Ringstead. A very late bird at Horsey Nov 29th.

Blackbird: A large autumn passage with maximum of 5,000 west Holme Nov 2nd.

Fieldfare: Latest in spring: Holme May 26th and Winterton May 28th. Earliest autumn record Holme (6) Sept 1st.

Redwing: Earliest in autumn 3 Shingham Sept 19th.

Mistle Thrush: One flying in off sea Yarmouth July 7th. Flock of 70 Pentney GP July 27th.

Cetti's Warbler: Reduced Broads total following severe weather of 26 singing males

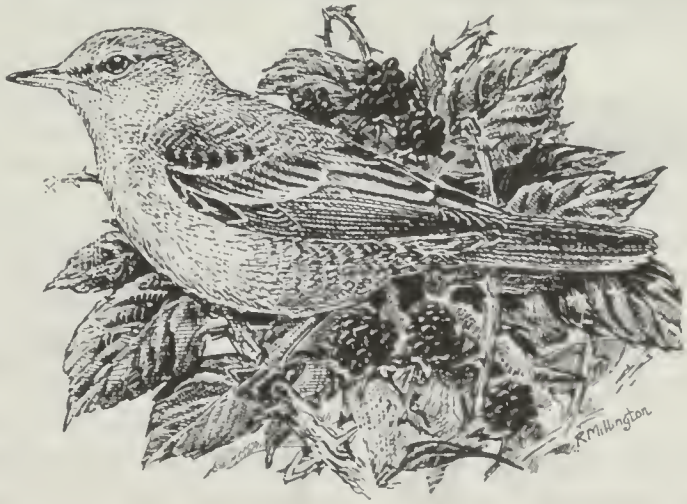
as follows: Brundall 2, Cantley 1, Coldham Hall 1, Horning Ferry 1, Hoveton Little Broad 1, How Hill (single March 25th only), Hudson Bay to Ranworth Dam 3, Martham 1, Rockland 2, South Walsham 1, Strumpshaw 4, Surlingham Church Marsh 1, Surlingham Broad 1, Ward Marsh 3 and Wheatfen 3. Elsewhere Titchwell Nov 27th.

Grasshopper Warbler: Earliest Holme April 8th. Rarely recorded on autumn migration in the county, but 4 such records in 1987: Blakeney Point Aug 26th, Oct 3rd and 20th and Paston Oct 4th.

Savi's Warbler: At Hickling first recorded April 16th with one, and occasionally 2, singing males there until end May. Elsewhere singing males near Horning April 23rd-25th, Cley May 19th-27th, Strumpshaw May 19th/20th and June 4th, Martham Broad May 25th and Horsey July 13th where another bird seen.

Marsh Warbler: Two records of singing males: Holkham Meals May 24th (PC) and in observer's garden at Elsing June 12th (AJP). The fifth and sixth county records.

Icterine Warbler: In spring one singing Cromer May 19th. Total of at least 18 autumn migrants: Waxham 3 Aug 26th, one 27th; Paston 2 Aug 28th; Cromer Aug 30th; Northrepps (in observer's garden) Aug 26th; Blakeney Point Aug 25th/26th with 2 on 27th; Blakeney Bank Aug 30th; Wells (East Hills) Aug 26th-30th; Holkham Meals 3 Aug 25th with another arrival 28th, still 2 on 30th and another Oct 3rd and Scolt Head Aug 25th and Sept 1st.



Barred Warbler: Nine typical autumn records: Waxham 2 Aug 26th and one Aug 30th; Wells (East Hills) Aug 26th; Holkham Meals different individuals Aug 25th and 28th and Sept 1st; Holme Sept 1st and Hunstanton GC Aug 28th-30th.

Lesser Whitethroat: A very late migrant, probably of Siberian race, Wells (East Hills) Nov 8th.

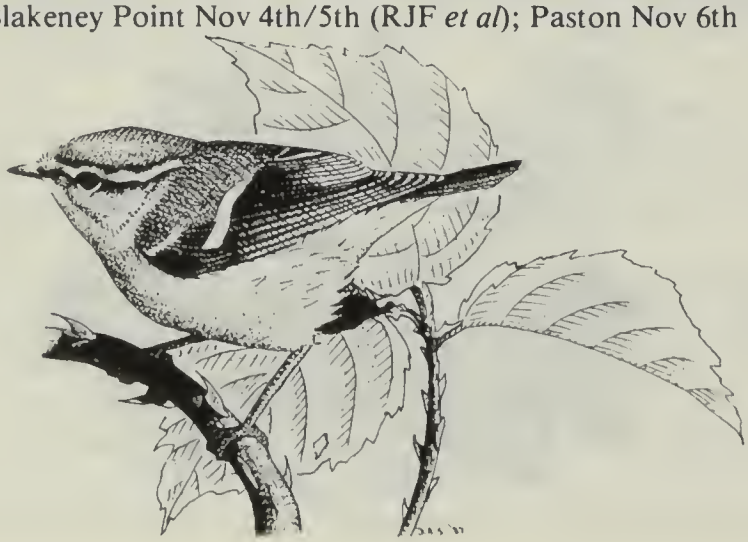
Whitethroat: A late migrant Horsey Nov 10th.

Garden Warbler: Earliest: Tottenhill GP April 24th. Notable fall Aug 26th when 80 Blakeney Point, 45 Wells (East Hills), 50 Holkham Meals and 35 Holme. Late migrants Holkham Meals and Holme (2) Oct 31st; Eccles and Wells (East Hills) Nov 1st and an exceptionally late bird Holkham Meals Nov 23rd.

Blackcap: In first winter period at King's Lynn Jan 10th, Surlingham village Jan 11th/12th, Swannington Jan 12th, Cley Jan 13th, different bird Jan 17th, Jan 25th and Feb 10th, Reepham Jan 14th, Norwich Feb 1st, Gressenhall Feb 7th-21st and Bradwell Feb 21st. Dec records for Cromer, Cley, Holme (2) and West Walton.

Greenish Warbler: At least 7 identified in the classic fall conditions towards end of Aug: Waxham 2 on 26th with one remaining till 27th (CJE *et al*), Paston 28th (MF), Blakeney Point 2 on 25th with one remaining till 30th (RA SJMG *et al*), Stiffkey 28th (GA *et al*) and Wells car park 25th-28th (GA *et al*).

Pallas's Warbler: Eight records of this former great rarity: Holkham Meals Oct 21st/22nd (AB JMcC) and 2 Nov 24th with one until 29th (JBK *et al*); Cley Oct 29th (SJMG *et al*); Blakeney Point Nov 4th/5th (RJF *et al*); Paston Nov 6th (JRA); Wax-



ham Nov 6th/7th (BAB CAB) and Wells (East Hills) Nov 8th (JMcC).

Yellow-browed Warbler: As usual majority of records from Holkham Meals where seen as follows: 2 Sept 26th, 3 Sept 27th, at least 6 Sept 29th, 4 Oct 3rd, 3 Oct 4th, 2 Oct 5th/6th, singles on several dates 7th-21st, 2 Oct 27th and a different bird Oct 28th to Nov 1st (at least 18 individuals involved). Elsewhere in Oct: Holme 1st and 20th/21st; Yarmouth, Stiffkey and Burnham Deepdale all 3rd; Horsey 6th and Waxham 25th-30th.

Radde's Warbler: Holkham Meals Oct 2nd (GDE MJE KMM *et al*). The eleventh county record.

Dusky Warbler: Blakeney Point Oct 3rd/4th (DA SJMG PH *et al*) and Happisburgh Nov 7th-11th (MSC MIE AMS *et al*). The eleventh and twelth county records.

Wood Warbler: Spring migrants (several singing) at Titchwell April 17th-May 5th, Burgh Castle April 24th, Holkham Meals April 23rd-27th and May 23rd, Holkham Park May 13th, Holme May 17th and Blakeney Point May 26th.

Singing males in breeding season at Brundall, Holt Hall, Horsford, Kelling (2), Lynford, Narborough, Norwich (Mousehold Heath), Snettisham (2), Surlingham, Swanton Novers (2), Thorpe St. Andrew and West Runton.

Six autumn migrants Aug 26th to 29th at Paston, Blakeney Point (2), Wells (East Hills 2) and Holkham Meals.

Chiffchaff: Four Jan records: Welney 1st, Cley sewage works 1st and 6th, Holme 3rd/4th (*tristis*) and Norwich (Stafford St) 9th and 21st. At Holkham Meals 3 Nov 24th, at least 5 Nov 28th, 5 Dec 7th, 3 Dec 13th and 2 Dec 19th; birds of *tristis* race here Oct 3rd and 11th, Nov 24th and 29th and Dec 19th. elsewhere *tristis* birds at Blakeney Point Oct 27th and Waxham Nov 21st. Birds of *abietinus* race Holkham Meals Nov 1st and Surlingham Church Marsh Dec 8th. Other Dec records for Cley 1st and King's Lynn (in observer's garden) from 2nd into 1988.

Willow Warbler: One showing characters of one of the eastern races Stiffkey May 30th. Three late autumn migrants: Yarmouth Nov 1st, Titchwell Nov 7th and Happisburgh (again of an eastern race) Nov 7th-10th.

Firecrest: Holkham Meals one from Dec 26th 1986 to at least Jan 6th; again recorded here from March 29th. Also Holme March 30th and Winterton March 31st. During

April widely reported with records from Blakeney Point, Cley, Felbrigg, Hickling, Holkham Meals (where up to 15 seen including 6 on 4th/5th, Holme (3 on 5th), Horsey, Lessingham, Lopham Fen, Paston, Strumpshaw, Swanton Morley GP, Thetford, Waxham (3 on 5th/7th), Weybourne, Winterton, Wiveton and Yarmouth. In May singles Thetford 10th, Holkham Meals 13th and 17th and Waxham 16th.

Only small number of autumn observations: Holkham Meals 1-2 Oct 2nd-22nd, Waxham Oct 3rd-5th with 2 on 4th, Holme 2 Oct 23rd/24th, Paston Oct 30th/31st, Thorpe St. Andrew Nov 4th and Happisburgh Nov 7th. One found dead Thetford Dec 11th.

Spotted Flycatcher: Latest record Blakeney Point Oct 3rd.

Red-breasted Flycatcher: Five typical autumn records: Holkham Meals Aug 30th and Oct 2nd/3rd, Thornham Point Oct 11th-15th, Holme Oct 20th/21st and Blakeney Point Oct 24th.

Pied Flycatcher: In spring migrants at Yarmouth April 20th-26th, Horsey April 26th, Paston May 20th, Sheringham May 22nd, Cley April 28th, Wiveton April 23rd, Holkham Meals up to 4 April 18th-25th and one May 6th and Holme May 17th-19th and 24th. Inland at Norwich (Lion Wood) April 27th and Mousehold Heath May 5th and King's Lynn May 14th.

Notable fall Aug 25th when 80 Holkham Meals and 20 Blakeney Point. A very late bird Weybourne Oct 31st.

Bearded Tit: Breeding records from Burnham Norton (1-2 pairs), Cley (about 10 pairs), Hickling (23 pairs), How Hill (one pair), Horsey (6 pairs), King's Lynn BF (3 pairs with maximum 45 Jan 7th) and Strumpshaw (3 pairs with maximum of 40 Jan 9th).

Recorded elsewhere as follows: Berney May 9th, Blakeney Point 12 high south-east Oct 17th, Burgh Castle 56 Oct 25th and 18 Nov 1st, Filby Broad 3 Oct 23rd, Holme 30 Oct 1st-5th and 17 Oct 19th, Lopham Fen maximum 35 Oct 12th, Rockland Broad/Surlingham Church Marsh up to April 4th and from Sept 28th (when maximum of 12), Snettisham Coastal Park 2 small parties Oct and Weybourne 9 Oct 17th-25th.

Long-tailed Tit: A party of 8 east Blakeney Point Oct 17th and a group of 10 apparently in off sea Cley Nov 29th.

Treecreeper: A very pale bird at Holme Nov 2nd considered by observer to be of North European race *familiaris* (WJAB).

Penduline Tit: Hickling a male April 4th-10th (DJH *et al*). An addition to the county list. See page 100.

Golden Oriole: In May calling males at Hardley Flood 4th, Weybourne 11th, Surlingham Church Marsh 14th, Holkham Meals 17th, Kelling 19th and Strumpshaw end of month. Also a male west Holme May 8th. In June a male calling Glandford 4th-6th, a pair Snettisham (Ken Hill wood) 16th, Titchwell 18th-20th, immature male Welney 27th and female Snettisham 28th. In July male calling Coldham Hall on 3rd.

Isabelline Shrike: An immature near Wells town Nov 1st-5th (many observers). The second county record of this now separate species, the first being in 1975 at the western end of Holkham Meals.

Red-backed Shrike: In spring males at Holme May 28th, Horning June 7th, Blakeney Point June 13th, Weybourne June 14th and Brancaster GC June 27th.

A pair bred in Brecks at Santon Downham rearing 4 young. A female Snettisham July 29th-Sept 6th.

Autumn migrants: Winterton Aug 13th and Oct 12th-17th, Waxham Aug 26th-30th, Paston Aug 26th and 2 Aug 27th/28th, Sheringham Aug 26th, Blakeney Quay Aug 30th/31st, Blakeney Point Aug 26th/27th, Wells Aug 27th-Sept 2nd with 2-3 Aug 29th, Titchwell Oct 13th, Holme Aug 21st/22nd, another by 26th, 2 27th-30th and 3 on 29th and Hunstanton GC 2 Aug 28th/29th and Sept 8th.

Great Grey Shrike: In first-winter period long staying birds at Titchwell Jan 5th-Feb 10th, Strumpshaw Jan 11th-April 17th and Barrow Common March 8th-April 14th. Elsewhere Sparham Jan 30th/31st, Bridgham Heath Jan 30th, Thorpe Great Heath Jan 31st, Snettisham Feb 8th and 15th, Denver March 9th, King's Lynn March 14th/15th, Thetford Warren March 29th, Alderford March 30th, Holme April 14th, Heacham April 16th, Salthouse Heath April 17th/18th, Kelling April 17th-21st and Hickling April 19th.

Only 4 records in second-winter period: Holme Oct 20th/21st, Hickling Oct 24th, Holkham Meals Nov 5th and Surlingham Broad Nov 15th.

Woodchat Shrike: Holme a female June 8th-10th (WJAB PRC *et al*).

Magpie: Buxton Heath roost 107 Feb 14th, 112 Feb 28th and 100 Dec 6th. Other counts at roosts included 42 Holme Nov 28th, at least 60 Roydon Common and 36 Horsford both Dec.

Hooded Crow: Very few records received in first few months of year: Shimpling (shot) Jan 7th, Fleggburgh Common 2 Jan 18th, Snettisham Jan 25th, Heacham Feb

13th and Stiffkey Feb 28th. More birds in April on passage including Winterton where maximum of 10 on 15th; other records then from Strumpshaw, Caister, Horsey, Cromer, Weybourne, Wiveton, Blakeney Point, Titchwell and Holme. Subsequently occasional singles at Blakeney Point May, Holme May-June and Breydon May-July; also West Harling July 8th. Only 5 records in second-winter period: Flitcham Sept 28th/29th, Cley Oct 25th, Holkham Oct 26th, Hunstanton Nov 5th and Sparham Nov 20th-24th.

Raven: Additional 1986: Wells in off sea Nov 15th (WP). First record of a likely genuine wild bird since 1974.

Rose-coloured Starling: Stalham an adult June 14th-25th (DJH RM *et al*).

Brambling: A singing male Holme June 10th.

Serin: The male re-appeared at Wells for the third year running being present April 8th to Aug 11th. Another male in song Brundall May 29th (BDH).

Siskin: Largest concentration 150 Bodney/Langford Feb 7th. Breeding occurred at Drymere and Wolferton.

Twite: Recorded to May 6th (Paston) and from Oct 2nd (Holme). Largest flock 180 Blakeney Quay Dec 13th.

Mealy Redpoll: Few records received: UEA Norwich 12 Jan 17th and 6 on 18th and Mundesley April 7th.

Arctic Redpoll: Additional records accepted by British Birds Rarities Committee:
1985: Holkham Meals April 14th (MCB).
1986: Winterton Dunes Jan 26th (PRC ALJ *et al*), probably another Feb 16th (TRB).

Crossbill: Regularly reported only in Brecks where largest group 32 Santon Downham Nov 7th. Elsewhere: Wolferton 2 Jan 21st and 3 Feb 28th, Morston 8 Feb 4th, Holme March 20th, 4 April 14th and 3 April 18th, Snettisham (Ken Hill Wood) June 13th and Holkham 3 in off sea Oct 21st, 12 Oct 23rd and singing male Dec 13th.

Hawfinch: Again present all year at a locality in TF70 where up to 17 Feb, 1-2 remained into July building up to a maximum of 28 in Dec. At Kelling 2 pairs bred successfully. Elsewhere ones and twos at Alderford Common, Attlebridge (roost held maximum of 3 Feb), Bagmore Farm, Barnham Cross Common, Breydon (Jan 31st), Colney, East Wretham, Feltwell, Holkham Park, Holme, Lakenheath Flash, Lynford, North Creake, North Walsham, Old Costessey, Ringstead, Salthouse Heath, Santon Downham, Snettisham, Stanford, Thorpe St. Andrew and Weybourne.

Lapland Bunting: Largest numbers at Burnham Norton (peak of 125 Jan 22nd) and Breydon/Berney (peaks of 53 Nov 17th and 50 Dec 9th). Also recorded at many other coastal sites especially in autumn with maximum of 23 Snettisham Nov 7th. Inland: King's Lynn BF Feb 8th, Buckenham Nov 10th/11th and 3 Dec 21st, Potter Heigham Nov 13th and overhead Rockland Broad Dec 30th. First in autumn Sept 13th (Winterton).

Snow Bunting: Maximum counts for individual localities include 350 Holkham late Nov, 110 Blakeney Point Jan, 105 Gore Point Dec, 100 Holme Dec and 100 Scolt Head Dec. Inland: Buckenham (2 April 7th, singles Nov 12th and 20th, Dec 11th-17th), Burgh Castle (5 Nov 1st) and Berney (42 Dec 28th). First in autumn Sept 14th (Lynn Point).

Ortolan Bunting: Single males at Waxham May 3rd (BWJ), Weybourne May 10th (BM MPT *et al*) and Blakeney Point Oct 4th/5th (JCD PJH BWJ).

This Red-rumped Swallow which stayed locally five days was photographed roosting in Cley Church porch. A major fall of wind-drifted Wrynecks commenced in late August.

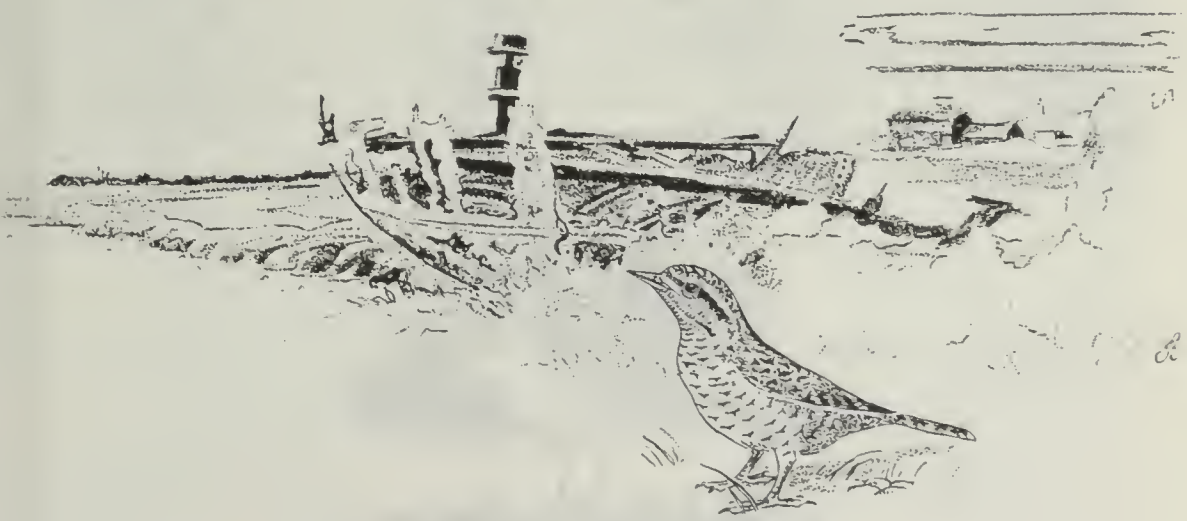
Exciting vagrants photographed at Cley: Two Slender-billed Gulls from the Mediterranean and a Red-breasted Goose from the Siberian tundra.

At New Buckenham a communal Long-eared Owl roost was occupied six weeks. Barn Owls continued nesting in derelict drainage mills, church towers and old barns.

Harvest Mice were widely reported including South Wootton and Great Hockham where cats supplied the evidence. Felines at Hempnall found Wood Mice less palatable.

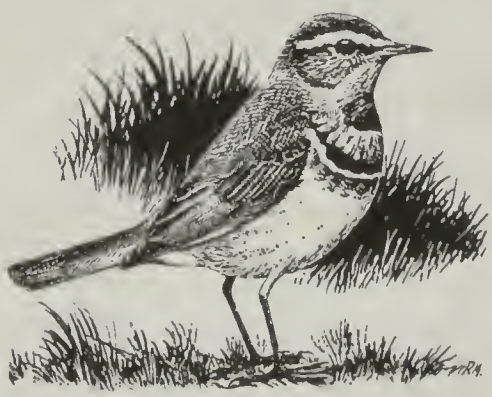
Rustic Bunting: Cley May 23rd (MRL *et al*).

The following breeding species, not mentioned in the Classified Notes, were recorded in 1987: Mute Swan, Canada Goose, Teal, Mallard, Red-legged Partridge, Grey Partridge, Moorhen, Coot, Lapwing, Stock Dove, Woodpigeon, Cuckoo, Tawny Owl, Kingfisher, Green Woodpecker, Great Spotted Woodpecker, Lesser Spotted Woodpecker, Skylark, Meadow Pipit, Dunnock, Robin, Redstart, Song Thrush, Sedge Warbler, Reed Warbler, Goldcrest, Marsh Tit, Willow Tit, Coal Tit, Blue Tit, Great Tit, Nuthatch, Jay, Jackdaw, Rook, Carrion Crow, Starling, House Sparrow, Tree Sparrow, Chaffinch, Greenfinch, Goldfinch, Linnet, Bullfinch, Yellowhammer, Reed Bunting and Corn Bunting.



CONTRIBUTORS TO THE BIRD REPORT

A. ABBOTT
S. ABBOTT
D. ABDULLA
R. H. ABERDEIN
P. R. ALLARD
R. I. ALLISON
G. ALLPORT
R. ANDREWS
C. APPLETON
J. R. APPLETON
D. ARCHER
R. ARCHER
B. ARMSTRONG
C. N. ARNOLD
D. N. ASH
D. ATKINSON
M. AUSDEN
A. BAKER
M. F. B. BAKER
T. BAKER
D. J. BAMFORTH
P. R. BANHAM
A. BANWELL
T. R. BARKER
M. J. BARRETT
H. G. M. BASS
M. A. BEEVERS
A. E. V. BELLARS
P. J. BENSTEAD
B. J. BEST
N. BETTS
S. BETTS
P. C. BEWICK
A. R. M. BLAKE
B. BLAND
A. BLOOMFIELD
P. S. BONAVID
T. E. BOND
E. F. BOOSEY
A. D. BOOTE
W. B. BOOTH
N. BOSTOCK
T. E. BOULTON
C. G. R. BOWDEN
G. S. BOWEN
W. J. A. BOYD
A. BOYES
P. BRADLEY
P. BRADNUM
MRS. M. A. BREWSTER
A. M. BROWN
J. F. W. BRUHN
R. J. BRUNTON
D. BRYANT
M. C. BUCKLAND
A. L. BULL
M. BURROWS
J. F. BUTCHER
R. BUTLER
B. A. BUTTLE
C. A. BUTTLE
J. J. BUXTON
C. R. G. CAMPBELL
H. CARMICHAEL
M. CARR
P. CARR
M. S. CAVANAGH
P. CAWLEY
D. CHARMAN
J. CHARMAN
G. CHASE
R. CHIDWICK
J. G. CHIPPERFIELD
P. R. CLARKE
P. CLEMENT
R. COBBOLD
DR. D. B. COLLINGE
M. COLMAN
P. R. COLSTON
A. S. COOK
T. COOK
MRS. B. COOMBS
B. J. COOPER
T. CORCORAN
J. E. CORLETT
G. M. CRESSWELL
C. CROSS
E. CROSS
MRS. G. CROSSLEY
J. CROSSTHWAITE
A. CURL
A. CURREY
W. G. DALE
W. A. DAVIDSON
T. C. DAVIES
T. E. DAVIES
I. H. DAWSON
J. C. DAY
C. H. DOBBS
A. le F. DOBSON
P. J. DOLTON
C. DONNER
D. A. DORLING
MISS E. DORLING
D. G. DOUGLAS
B. DRIVER
N. A. DRIVER
W. DRIVER
G. E. DUNMORE
C. J. DURDIN
K. R. DYE
J. EAMES
J. C. EATON
M. J. ECCLESHALL
I. EGGELTON
M. I. ELDRIDGE
G. D. ELLIOT
M. ELLIOTT
H. ELLIS
MRS. H. ELLIS
G. J. ETHERINGTON
V. EVE
M. J. EVERETT
M. FAINT
R. FARNDON
F. J. L. FARROW
D. FILBY
K. FISHER
P. FISHER
M. FISZER
M. R. FLACK
T. FLETCHER
B. C. FORRESTER
A. FORSYTH
R. A. J. FORSYTH
D. FOSTER
R. J. FOWLING
R. A. FOYSTER
R. FRANCIS
M. P. FROST
S. J. M. GANTLETT
M. S. GARNER
J. D. GEESON
MRS. J. E. GEESON
N. GIBBONS
M. GILBERT
D. J. GIRLING
T. M. GIRLING
P. A. GLUTH
J. GOLDSMITH
P. GOODEN
G. GRAYSON
G. GRIFFEN
J. GUDGEON
A. J. HALE
J. HAMPSHIRE
VEN A. M. HANDLEY
M. HANNANT
B. HARDING
A. F. HARNS
E. J. HARRIS
S. P. HARRIS
K. K. HARRISON
R. B. HASTINGS
S. J. HAYHOW
P. J. HAYMAN
P. J. HEATH
D. HENSHILWOOD
D. HERRIEVEN
D. J. HEWITT
J. C. HEWITT
G. HIBBERD
R. HOBBS
R. HOBLYN
P. HOBSON
D. J. HOLMAN
D. HOLMES
G. HORSLEY
P. R. HUGO
R. HUMBY
R. E. HUMPHREY
R. A. IMAGE
A. G. JACKSON
B. W. JARVIS
P. A. JEFFERY
A. JENKINS
C. J. JENNINGS
R. JENNINGS
G. JESSUP
R. JOLLIFFE
R. JOHNS
J. JOHNSON
S. C. JOYNER
G. JUDD
S. JUDD
C. R. JUPP
G. KEELE
G. I. KELLY
L. KELLY
C. KELSEY
F. D. KELSEY
R. N. KELSH
J. B. KEMP
DR. I. F. KEYMER
MRS. J. KEYMER
C. KIGHTLEY
J. KINSLEY
P. D. KIRBY
C. A. E. KIRTLAND
DR. P. G. KITCHENER
C. R. KNIGHTS
D. LAKE
P. LAMBERT
A. L. LAST
J. M. LAST
DR. R. M. LEANEY
M. P. LEE
D. LESTER
DR J. LINES
A. J. LIVETT
L. B. LOCKHART
P. LOCKWOOD
A. LONG
P. LOUD
R. LUDFORD
J. D. MAGEE
R. C. MANSFIELD
J. H. MARCHANT
MISS H. MASSON
N. MAXWELL
D. MAYES
P. A. McANULTY
J. R. McCALLUM
R. C. McINTYRE
MRS. R. C. McINTYRE
N. MEARS
J. S. MIGHELL
MRS. J. S. MIGHELL
R. MILLINGTON
M. MITCHELL



CONTRIBUTORS TO THE BIRD REPORT (continued)

R. MONTEITH
B. MOORE
J. D. MORTEMORE
K. M. MORTON
W. S. MORTON
J. A. W. MOYES
B. MURPHY
E. T. MYERS
National Trust
R. NEALE
R. NELSON
R. E. NEWHAM
M. NEWTON
R. NICHOLS
Norfolk Young Naturalists
Norwich YOC Group
D. J. ODELL
M. OTSU
MRS. Z. OWENS
T. R. PALMER
J. PARFITT
J. L. F. PARSLOW
R. PARTRIDGE
DR. M. PETCH
D. PETRIE
S. PLANT
MRS. T. PLANT
C. POOLE
W. PORTEOUS
M. H. POULTON
A. J. PRATER
R. PRESTON
A. L. PYE
J. L. RAINCOCK
M. RAINS
H. RAMSAY
M. S. READ
J. REED
D. REVETT
J. REVETT
F. P. J. REYNOLDS
P. RILEY
R. RISE
K. RIVETT
C. ROBSON
A. R. J. ROE
S. ROOKE
M. E. S. ROONEY
S. ROPER
R. ROWE
R.S.P.B.
A. T. M. RUCK
F. RUSSELL
M. D. RUSSELL
W. RUTHERFORD
B. A. RYAN
D. SAMPSON
K. G. SAUL
R. W. SAUNDERS
M. SAUNT
C. SAYER
H. SCHOFIELD
A. SCOTT
M. J. SEAGO
MRS. S. F. SEAGO
K. W. SELF
MRS B. SENIOR
R. SHAW
D. SHEPHERD
J. SHEPHERD
W. SHEPHERD
D. SHOWLER
N. SILLS
C. J. SMALL
R. A. SPAIN
Stanford Trg Area Bird Group
P. STEELE
A. M. STODDART
L. C. STREET
MRS. S. STREET
R. SUMMERS
K. SWIFT
D. TALKS
D. P. TATAM
G. TAYLOR
DR. M. P. TAYLOR
M. G. TELFER
Thetford Nat. Hist. Socy.
K. THOMAS
R. THOMAS
D. W. TITTERINGTON
T. D. TOWNSEND
R. B. TOZER
J. S. TRIMINGHAM
MRS. B. M. E. UNSWORTH
P. VARNEY
A. E. VINE
A. VITTERY
S. C. VOTIER
R. WALDEN
R. J. WALKER
J. WALLIS
G. W. WANT
F. A. WARDMAN
A. WEIR
J. WELSBY
D. I. WEST
MRS. J. WHILLOCK
G. J. WHITE
J. WHITE
M. L. WHITE
S. WHITEFORD
J. R. WHITELEGG
J. WILKINSON
MRS. J. WILLEY
N. WILLIAMS
J. R. WILLIAMSON
C. R. WILLS
J. WILSON
P. H WILSON
M. J. WOOD
G. WOODHOUSE
A. WRIGHT
S. J. WRIGHT
K. ZEELAND

Photographs: Titchwell Waders (*N. Carmichael*); Adult and young Black-winged Stilt (*P. R. Clarke*); Wryneck (*D. M. Cottridge*); Fulmar (*D. A. Dorling*); Avocets and Barn Owls (*A. L. Howes*); Sandwich Terns (*R. Jones*); Marsh Sandpiper, Grey Phalarope, Young Black-winged Stilt, front cover Black-winged Stilt and Rabbits (*C. R. Knights*); Red-rumped Swallow (*T. Loseby*); Long-eared Owl, Harvest Mouse, Wood Mouse and Stoat (*R. Tidman*); Slender-billed Gulls (*Dr. P. Wheeler*) and Red-breasted Goose (*B. Wingrove*).

Line Drawings: 118 Caspian and Common Terns and 125 Long-tailed Ducks (*N. Arlott*); 104 Grey Plovers, 139 Shorelarks, 141 Bluethroat, 146 Pied Flycatchers and 149 Wryneck (*B. Bland*); 142 Ring Ouzel (*D. Bryant*); 153 Fallow Deer, 154 Coypu, 158 Weasels, 159 Hedgehog, 162 Water Vole and 167 Common Seal (*J. Last*); 81 Hen Harrier and Merlins, 82 Night Heron, 83 Great Snipe, 86 Goldcrest and Yellow-browed Warbler, 89, 94, 96 and 127 Black-winged Stilts, 97 Great Bustards, 100 Penduline Tit, 102 Slender-billed Gulls, 131 Marsh Sandpiper, 132 Ringed Plover, Little Ringed Plover and Wood Sandpiper, 133 Wilson's Phalarope, 134 Pomarine Skuas, 136 Caspian Tern, 140 Olive-backed Pipit, 143 Icterine Warbler and Barred Warbler, 145 Radde's Warbler, 147 Rose-coloured Starling, 149 Red-rumped Swallow, 150 Bluethroat (*R. Millington*); 41 Red-rumped Swallow, 120 Purple Heron and 144 Pallas's Warbler (*M. Read*); 122 Brent Geese, 124 Ring-necked Duck, 138 Hoopoe and 144 Yellow-browed Warbler (*D. Showler*); 126 Merlins (*I. Willis*); 103 Lapwings, 105 Bar-tailed Godwit, Oystercatcher and Ringed Plover, 112 Sandwich Tern, 120 Spoonbills and 121 Bewick's Swans and Pintails (*the late R. A. Richardson*).

NORFOLK MAMMAL REPORT 1987

Editorial

The Editor is pleased to present the 32nd Norfolk Mammal Report.

The main topic of the year is the final chapter of the Coypu story. This was well-documented even before these reports were instituted by articles published in the Transactions of The Norfolk and Norwich Naturalists' Society so we can feel justifiable pride in presenting the full account from the Coypu's original escape from Nutria farms to the demise of the last representative of the species. Yet there does remain a tiny shadow of doubt. We know how elusive even the largest of our mammals can be. Is there in some remote and unexpected corner, in spite of all the efforts of the trapping team, the nucleus of a breeding colony? Only time will tell.

The eradication campaign has been massive and costly. It does prove that if the willingness is there to devote enough time and money to back a professional team, results can be achieved.

We think of certain other species that cause actual damage and have a deleterious effect on other wildlife. Could not the same single-minded and organised approach control them more effectively. We think of Grey Squirrels and Magpies that are attractive to watch but are becoming serious pests in many parts of the county. Others would argue that any species either native or introduced should be allowed to run its natural course and reach its own state of balance.

We must not be self-congratulatory when we speak of our achievements in reporting on the Coypu. We have been priviledged to publish papers by the most knowledgable specialists and are immensely grateful for their contributions. Doctor Morris Gosling has spent a great part of his working life researching this animal and year by year has kept us up to date on its story. From time to time he has contributed major articles to our report and this year we have what may be the final word. In thanking him for this and all his contributions, we wish him well for the future and express the hope that we will continue to benefit from his friendship and also his expertise gained from his future research whatever line it takes.

The surprise of the year was the unexpected numbers of Harvest Mice noted. Several new squares were added to the distribution map, just in time for its publication in this report together with maps for Wood and House mice. Again we have to point out that the maps do not necessarily include all actual sites for the mammal concerned, only those from which records have been obtained since 1975. It may be that a species has even been lost from a mapped location. Why the Harvest mouse should have had such an upsurge isn't known. Most species of small rodents had a good year. The late harvest may have contributed to the Harvest mouse's ability to produce more successful litters.

The mammal that has increased during the last decade is one that strictly speaking lies outside this report, yet its impact on the scene in an indirect way has to be taken into serious consideration. It is the domesticated dog in its myriad forms. We link with this the increase in motor transport. Add to these the higher densities of human

population. The resulting combination enables the two that take their exercise together to travel speedily many miles in comfort to seek out the quietest, most varied wildlife habitats, those very special spots that give the greatest pleasure. Some of our contributors have developed an interest in natural history through such gentle pursuits. How sad that some of those key areas have been seiriously reduced in quality by being discovered by just too many tyres and trampling feet.

Norfolk is extremely fortunate to include within its boundaries internationally recognised jewels of nature. Their dazzle must not blind us to escalating threats coming in many guises to other, less well protected, gems. Profit and sophisticated pleasure must not be allowed to leave our wildlife the poorer.

We thank again our many contributors who have made this report possible. They include such specialists as Doctor Morris Gosling, Coypu Research Laboratory, and Rex Whitta, Wildlife Ranger of Thetford Forest. John Last has enhanced our pages with more of his delightful vignettes. Many others, known only through their regular annual reports, have become old friends. Their letters are eagerly awaited each year.

The standard of observation and submissions continues to rise which makes the business of editing so much easier. Grid references are more frequently used so the distribution maps are less onerous to compile and keep up to date. Without them, the names of Norfolk villages can be somewhat confusing and even obscure!

The Ordnance Survey map is an important item of equipment for the natural history recorder but we do realise that the reference system can be, like riding a bicycle, very difficult till you master the technique. There is a very brief instructional note printed on the maps but if any further guidance is needed, please do not hesitate to ask. We are able to supply a much fuller instructional sheet, or even better, discuss the matter in person or over the phone.

A form has been devised to simplify recording and supplies can be obtained directly from the Castle Museum. Again they are not essential. Scraps of information come in on the merest scraps of paper. Of course, an interesting anecdote always livens up the account!

The report is only a distillation of all these offerings. Without them it would cease to exist. Time and postage do not allow individual replies so we trust these notes form sufficient acknowledgement. We have, to our shame, been known to omit a name or two from the list of contributors. If this has happened again we do most humbly apologise.

Material for the next report should be in the Editor's hand *as early as possible in 1989*. Send to Rex Hancy, Ardea, 124 Fakenham Road, Taverham, Norwich, NR8 6QH. Telephone: Norwich 860042.

The ever-helpful and supportive John Goldsmith continues to guide the course of all vertebrate studies from the Natural History Department in Norwich Castle Museum. His telephone number is Norwich 611277 Extension 286.

A history of Coypus in Britain: 1929 to 1988

L. M. Gosling, Coypu Research Laboratory, Ministry of Agriculture, Fisheries and Food, Jupiter Road, Norwich NR6 6SP.

Coypus, *Myocastor coypus* are hystricomorph rodents, native to South America but with a world-wide distribution following escapes from captivity or deliberate introductions. They are tolerated when cropped for fur or meat (Gosling and Skinner, 1984) but elsewhere they are controlled because of damage to crops (Norris 1967a), drainage systems (Cotton, 1963) and native plants (Ellis, 1963; Boorman and Fuller, 1981).

The main enemies of coypus in Britain are man and cold weather. They are quite easy to catch using simple cage traps (Norris, 1967b) and this technique has the advantage that non-target species can be released unharmed (Baker and Clarke, 1988). In cold weather coypus lose condition and suffer severe frost lesions. Many females abort during severe winters (Gosling, 1981a) and juveniles perish in large numbers. Adults survive relatively well except in exceptionally cold weather; in the winter of 1962/63 90% of the population perished (Norris, 1967a).

There have been various attempts to limit coypu numbers and, as information has accumulated, it has become possible to plan these operations on a more scientific basis. Since 1981 an attempt has been made to eradicate coypus from Britain and this paper outlines the background and preliminary results of this campaign. The decision to attempt eradication took account of the fact that although coypus are much reduced in South America, they are not endangered there.

Early history: 1929 to 1969: Coypus were first imported for fur farming in about 1929. Fifty farms were established and all were closed down by 1940 (Laurie, 1946). Many animals escaped and feral coypus became established in the River Yare valley in Norfolk and in Buckinghamshire; this latter group persisted until about 1954 then disappeared (Norris, 1967a). Their potential for environmental damage was recognised but initial attempts to control their numbers were only sporadic; 193 coypus were trapped in Norfolk between 1943 and 1945 (Laurie, 1946). The impact of these efforts is unknown but the lack of further, concerted action led to a progressive expansion in range and numbers.

By the late 1950s coypus had spread through East Anglia and were causing serious damage. This included a massive decline in reedswamp in the Norfolk Broads (Boor-

man and Fuller, 1981; Ellis, 1965) and an alarming reduction in favoured food plants, such as cowbane, *Circuta virosa* (Ellis, 1965). Following local representations, rabbit clearance societies were grant aided to control coypus and by 1961 the East Suffolk and Norfolk River Board employed 15 trappers. In the year up to April 1962 70,000 coypus were killed by these agencies. At this time the population was believed to number 200,000 (Norris, 1967a) although this may have been an overestimate. In 1962 the Ministry of Agriculture, Fisheries and Food (MAFF) commenced a large scale trapping campaign, co-ordinated by 12 MAFF trappers and supported by Rabbit Clearance Societies, occupiers, River Boards and Internal Drainage Boards. This operation aimed to reduce coypu numbers and confine the survivors to the Norfolk Broads; this was broadly achieved although not without the help of the severe 1962/63 winter. At the end of this campaign in 1965 a semi-autonomous organisation called Coypu Control was set up with five trappers to maintain the position that had been achieved.

Research on population ecology: 1970 to 1980: When Coypu Control was given its caretaker role in 1965, little was known about the complex relationship between control intensity and the response of a coypu population; for example, it was not known how many trappers would have been needed to achieve the objectives of the first campaign if the winters had been mild. With hindsight we know that five trappers could not prevent an eruption when conditions are favourable for coypus. This was demonstrated in the early 1970s when the coypu population began to double each year in a run of mild winters. An increase in trapping, slowed but could not stop the increase and by 1975 there were about 19,000 animals. The trapping force was increased to 15 by 1973 and, with the help of some cold winters from 1975 onwards, this was just enough to prevent major increase in numbers. At this time Coypu Control was financed on a year-to-year basis and there was some reluctance to commit funds to what appeared to be an open-ended programme.

The Coypu Research Laboratory was established in 1962 and after a period when reproductive biology was studied (Newson, 1966) the laboratory concentrated on trying to understand variation in the numbers of coypus and in particular on the effect of various levels of trapping on population size. Data were collected from large numbers of dissections of animals trapped during control operations including estimates of age structures and reproductive performance. This information was used to establish two basic techniques. The first was a reconstruction of numbers in the past. Trapping is responsible for nearly all adult deaths and, by ageing the animals caught (from eye lens weight) and extrapolating each life back in time, the numbers which must have been present in the past were estimated at monthly intervals (Gosling, Watt and Baker, 1981). It was then possible to explore the response of these numbers to past variation in trapping intensity and climatic variation. The second technique was to construct simulation models of the population. These models included reproductive performance measured from post-mortems and death rates calculated from results recorded by Coypu Control trappers. Eventually, various numbers of trappers could be entered into the models to understand the relationship between control effort and the response of the population under different climatic circumstances (Gosling, 1981b; Gosling, Baker and Skinner, 1983).

These models suggested that the coypu population could be kept stable by 20 trappers with permanent mild winters and that a larger force could eventually eradicate it. To check this prediction, the laboratory trapped a 30km stretch of the River Yare valley at high intensity for six years. The main problem was that as coypus were cleared, they moved in from areas which, at that time, were controlled less effective-

ly. However coypus were completely removed from parts of the study area not affected by immigration showing that eradication was a practical option (Gosling, Baker and Clarke, 1988).

In 1977 an independent committee, the Coypu Strategy Group, was set up to consider long term policy for the control of coypus. The options were (i) open-ended control, (ii) an eradication attempt, and (iii) giving up control altogether. The group considered evidence from farmers, drainage interests, biologists and conservationists; all argued for strict control or eradication. The Coypu Research Laboratory also provided detailed information about the various control options, and their consequences. After considering all the evidence the Strategy Group decided that an attempt should be made to eradicate coypus in the long term and that in the medium term a trapper force should be employed which would reduce numbers, even over mild winters (Anon, 1978).

The eradication campaign: 1981 to 1988: The recommendations of the Strategy Group were accepted by the MAFF in 1980. Twenty-four trappers would work for a reconstituted Coypu Control Organization. The eradication campaign would be funded 50% by MAFF, 40% by Anglian Water and 10% by Internal Drainage Boards at an expected cost of about £2.5 million. There was also some debate about the effect of re-equipping the trapping force. In previous years equipment had been inadequate and it was not known to what extent four-wheel drive vehicles, unlimited traps and improvements in trapping techniques could influence events. Finally, it was decided that with these improvements it should be possible to eradicate coypus within ten years. The need to provide the trappers with an incentive was also appreciated since if they succeeded in eradication within six years; after six years the bonus would slowly decline.

The campaign started in 1981 and has been monitored and guided by the Coypu Research Laboratory (Gosling and Baker, 1987). Trapping intensity was more than double that before 1981, seldom falling below 200,000 trap-nights per annum. Trapper deployment was planned using the ratio between the numbers of coypus caught and the trapping effort expended (an index of relative abundance) in each of a number of strategic regions (Gosling, 1981b). Initially, trapping was concentrated in areas of high density to maximise capture rates and then deployed more widely in later years. One of the most difficult problems was the large area over which trapping needed to be carried out (Figure 1).

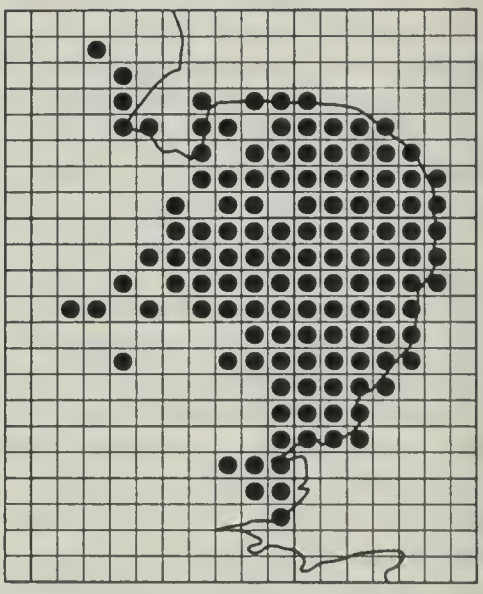


Fig. 1. The distribution of coypus trapped during the eradication campaign, 1981-1987. Over 35,000 animals were caught during this period.

As expected, coypus declined sharply during the campaign (Figure 2). Over 5,200 adults in 1981 were reduced to less than 20 by the end of 1986. As in the past this decline was faster over cold winters, mainly because of the reduced reproductive success of females at such times. The Coypu Strategy Group had suspected that it might become more difficult to reduce the population as individual animals became more

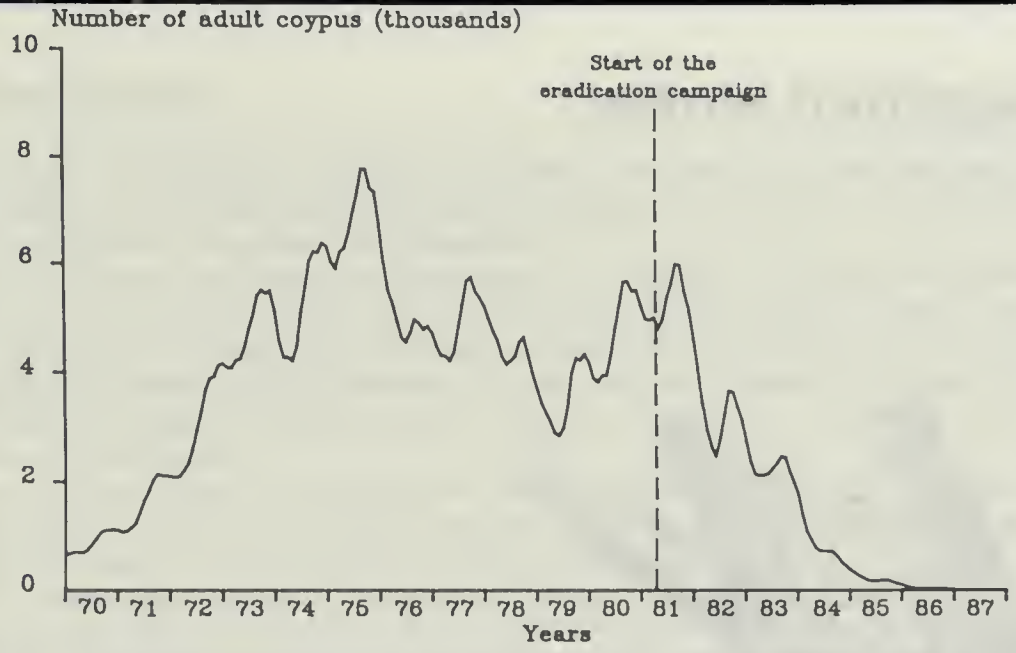


Fig. 2. Total estimated numbers of adult coypus between 1970 and 1981. See text for details.

difficult to find and catch at low density. In the event, the difficulty for coypus in finding mates and the consequent decline in reproductive success had a larger effect and the population declined more quickly than expected after it had been reduced to low density in 1985 and 1986 (Gosling and Baker, 1987). Only 12 coypus were trapped in 1987 and, at the time of writing (June 1988), none have been caught since April 1987, even though intensive trapping by the Coypu Control trapper force has continued. In addition, staff from the Research Laboratory have been checking whether any coypus remain by deploying large numbers of baited rafts, some equipped with automatic photography to detect coypus that visit. Again these techniques have failed to detect any coypus since April 1987. But, although 14 months without any sign of coypus is significant, it is too early to say whether or not they have been eradicated. Given the extent of the East Anglian waterways it is quite likely that scattered animals remain and, at this point, the success of the campaign still hangs in the balance.

References

ANON. (1978). Coypu: Report of the Coypu Strategy Group. Ministry of Agriculture Fisheries and Food. BAKER, S. J. & CLARKE, C. N. (1988). Cage trapping coypus on baited rafts. *J. appl. Ecol.* **25**: 41-48. BOORMAN, L. A. & FULLER, R. M. (1981). The changing status of reedswamp in the Norfolk Broads. *J. appl. Ecol.* **18**: 241-269. COTTON, K. E. (1963). The coypu. *River Board Ass. Yb.* **11**: 31-39. ELLIS, E. A. (1965). *The Broads*. Collins, London. GOSLING, L. M. (1981). Climatic determinants of spring littering by feral coypus, *Myocastor coypus*. *J. Zool. (Lond.)* **195**: 281-288. GOSLING, L. M. (1981b). The dynamics and control of a feral coypu population. *The Worldwide Furbearer Conf. Proc. (Ed by J. A. Chapman & D. Pursley)*. pp. 1806-1825. Univ. Maryland. GOSLING, L. M. & Baker, S. J. (1987). Planning and monitoring an attempt to eradicate coypus from Britain. *Symp. Zool. Soc. Lond.* **58**: 99-113. GOSLING, L. M., BAKER, S. J. & SKINNER, J. R. (1983). A simulation approach to investigating the response of a coypu population to climatic variation. *EPPO Bull.* **13**: 181-192. GOSLING, L. M., BAKER, S. J. & CLARKE, C. N. (1988). An attempt to remove coypus (*Myocastor coypus*) from a wetland habitat in East Anglia. *J. appl. Ecol.* **25**: 49-62. GOSLING, L. M. & SKINNER, J. R. (1984). Coypu. *Evolution of Domesticated Mammals*. (Ed by I. L. Mason). pp. 246-251. Longman, Essex. GOSLING, L. M., WATT, A. D. & BAKER, S. J. (1981). Continuous retrospective census of the East Anglian coypu population between 1970 and 1979. *J. Anim. Ecol.* **50**: 885-901. LAURIE, E. M. O. (1946). The coypu (*Myocastor coypus*) in Great Britain. *J. Anim. Ecol.* **15**: 22-34. NEWSON, R. M. (1966). Reproduction in the feral coypu (*Myocastor coypus*). *Symp. Zool. Soc. Lond.* **15**: 323-334. NORRIS, J. D. (1967a). A campaign against feral coypus (*Myocastor coypus* Molina) in Great Briatin. *J. appl. Ecol.* **4**: 191-199. NORRIS, J. D. (1967b). The control of coypus (*Myocastor coypus*) by cage trapping. *J. appl. Ecol.* **4**: 167-189.

Classified Notes

Although no hedgehogs *Erinaceus europaeus* were noticed in an Attleborough garden for the first year since recording began there, their presence in the district was sadly certified by numerous road casualties.

The dry spring, wet summer and mild autumn may have suited the life-style of this species very well. We have come to expect our regular annual crop of queries concerning the helping of late arrivals in the breeding season to build up body weight. The problem is well illustrated by the youngster weighing a maximum of 225 grams with a length of 15cms that was feeding on a lawn at 3.15 p.m. on a late November afternoon.

As the year closed, many adults as well as young were seen out foraging. It is hoped they were in good condition and continuing to feed, so shortening their period of hibernation and enhancing the probability of survival.

A strange tale from East Tuddenham! What else but a hedgehog, asks our contributor, would eat half a frog — lengthwise! The unfortunate amphibian was neatly and accurately bisected. Late in the year a half-grown hedgehog was found attempting to eat a toad. This time the intended victim was rescued with little damage done.

Only one hedgehog was noted on Belton Marshes where the Mole *Talpa europaea* was very numerous. There were more than ever in the Breckles, Hockham, Wretham area we are told and the connection is made with the retirement of a well-known local mole-catcher. "Moonscape lawn due to shallow runs" is a vivid description of the damage that can be caused to a carefully tended garden.

Common Shrews *Sorex araneus* and Pigmy Shrews *Sorex minutus* turn up regularly in owl pellets though this form of recording is becoming increasingly more difficult due to the scarcity of the material. References were county-wide for both species from a wide range of habitats including Morston Quay. Both were found to have a partiality for cat food at Edgefield. This form of supplementary diet is frequently put out for hedgehogs. Other species may be picking up the habit.

Dead shrews are frequently found so identification is made much easier. Cats continue to provide another high proportion of finds sometimes to the inconvenience and embarrassment of their owners. The most unusual Pigmy Shrew was the one

very active indoors at East Ruston.

A Pigmy Shrew record submitted, and allowed for 1987 was of a recently dead one found in a rhubarb bed during the very first days of 1988.

The Water Shrew *Neomys fodiens* is the most illusive species in the group. Lynford, Horning and Titchwell provide the only records for the year. It is interesting to note that none of these locations featured on last years list.

This attractive mammal is proving even more difficult than most to monitor. Difficulties of observation mean that its study must be over a long term and it may well be that we are already too late. Systematic searches on at least a yearly basis of all previously known habitats ought to be instituted. It all depends on having the right people in the right places.

CHIROPTERA

Nearly forty submissions were made on Pipistrelle bats *Pipistrellus pipistresllus* for 1987. This is probably a good indication that bats are being taken more seriously and are considered worthy of study, recording and protection. The earliest was seen flying on 7th February at Hardingham. Others were noted through to the end of the year in various parts of the county. There is always the possibility that odd individuals may be seen when they move from one hibernation site to another during the course of the winter. Such changes of surroundings are delicate balancing acts between energy loss due to physical activity and energy saved by transferring to a more suitable residence. These tiny bats have been reported as seemingly taking advantage of a quick snack as they fly through swarms of winter flying insects.

Noctules *Nyctalus noctula* were seen at Rockland Broad, Horstead, Burgh Common and Wroxham which was a new sighting for our recorder there. There were two further references from the south west of the county.

The greatest number of reports of Noctules were from the Norwich fringe, Carey's Meadow to the east and the banks of the Wensum running out from Anderson's Meadow to Costessey on the west. On 17th September a Noctule was seen flying over Grapes Hill part of the Norwich Inner Link Road. This is just a few flying minutes from the riverside for this our largest bat.

Long-eared bats *Plecotus auritus* were seen at Holme Hale, Corpusty and Taverham and in three references in the west.

Daubenton's bat *Myotis daubentoni* and Natterer's bat *Myotis nattereri* are very difficult to identify in flight and our records are mainly from hibernation sites in tunnels and kilns.

John Goldsmith tells us that the former makes up 44.6% of the individuals found in the 69 known occupied sites and the latter follows with 38%. Long-eared bats are next with 12.3%, Brandts/Whiskered *Myotis brandti/mystacinus* fill 3.6%, and lastly Barbastelle *Barbastella barbastellus* with 1.5%. These figures are based on the maximum numbers of individual species recorded on any single visit at the different sites over the 25-year period of recording.

99 suitable sites have been logged and there is a handful of further possiblities. Information on other likely spots is now very difficult to come by for our county has been most thoroughly checked by our bat enthusiasts. The very grave problem is that over a quarter of the sites have been lost for ever in the last 10 years and this process is multiplying at an alarmingly distressing rate. No less than eight of these losses occurred during 1986/87.

LAGOMORPHA

Reports on the Brown Hare *Lepus capensis* run from 'less than in past years' in the Horstead, Buxton district, through 'static' round Snettisham to 'numerous' at Hardingham. This apparent contrary evidence is reinforced by the many seen on Belton Marshes against the few a short distance way at Breydon. All this points to the literally vital factor, from the hares' point of view, of the level of predation which includes all types from the natural process of foxes taking the leverets to highly organised hare shoots.

Time of year and general conditions play their part. Hares move to where the feeding is good and where they can find a degree of protection from the elements. Large numbers find their way to such hare havens during the winter, feeding in from large sectors of the surrounding, bleaker, countryside. A report from a delineated area which includes observations and careful checks of numbers seen through all the seasons would make a very useful study and interesting reading.

One of the plentiful supply of hares at Hardingham made frequent visits to a garden there. Up to early September it occasionally found its way into a paved courtyard. The timid hare can sometimes be seen behaving in such a bold way. Workers taking their lunch break in a barn were visited by a hare which stayed with them for some time before ambling out again in a most unconcerned manner.

The general trend of observations concerning the Rabbit *Oryctolagus cuniculus* is that there are more about, subject all the time to local outbreaks of myxomatosis. All parts of the county are covered, including Blakeney Point. Exceptionally few were seen in Lingwood. More were frequenting Belton Marshes until stricken by the deadly virus.

A half-grown youngster spent three days in a Snettisham garden. No doubt that the effect upon the crops was similar to that noted by the Editor on his Taverham plot.

A garden in Hempnall sums up the whole rabbit story in Norfolk. In January an adult was apparently well-established within the garden boundary. A cat caught and ate a baby rabbit in February. Presumably the same predator was responsible for the rabbit skin left in the kitchen during March. By the end of that month the cats were taking an average of one rabbit per day. It was in May that myxomatosis struck. By August there were very few to be seen and none were brought in by the cats. It is believed that numbers may also have been reduced to a tiny remnant by the gassing of a local warren.

RODENTIA

Thetford Naturalists' Society tell us they had very few sightings of Red Squirrels *Sciurus vulgaris* during the year. Are we being patient enough they ask? Their Society is centred near the most favourable grounds in Norfolk for any views of this species. Most of us would be thrilled to see any at all. Apart from the representatives of the stable but scattered population in the Thetford Forest, we have only one other on the card and that is from Wells woods. It was seen in February.

Grey Squirrels *Sciurus carolinensis* are plentiful not only in Thetford Forest but over most of the rest of the county. Scolt Head recorded its first during the year although it stayed only a short time. Far more are killed on the roads nowadays, surely an indication of the general increase.

Householders at Thorpe-next-Norwich were feeling quite harrassed at one point

by the large numbers in their gardens. Some of the squirrels began to enter roofs and lofts, showing a high degree of house-breaking skill at bypassing many devices attempting to keep them out.

G.J. reports numbers as high as last year in his area round Watton and tells us that much more devastation of young trees was reported to him. He received five phone calls after Grey Squirrels were suspected of robbing young birds and even adults near nest boxes.

A quote from another contributor discussing their destructive potential — "Don't think they don't occur in arable land. So long as there is a hedge to follow, wanderers will follow it. When they get hungry in early summer they will snip straws of wheat, or what-have-you, and eat the milky grain on the spot."

Bank voles *Clethrionomys glareolus* generally live far less public lives, apart from the half-tame colony at Holme observatory. Visiting members of the public have been charmed by the antics of these creatures. It is extremely amusing, we are told, to see a Bank Vole hanging on a strung-up red apple, after the manner of a Bluetit.

The number of records submitted suggests that 1987 was a very good year for the species and the same comment applies equally well to the Short-tailed Field Vole *Microtus agrestis*. The bulk of individuals listed were found in owl pellets in which they generally formed by far and away the highest proportion of prey taken. The only area running against the general trend was Belton where fewer were seen. Edgefield sums up the more typical situation where a very careful recorder is provided with material to quantify by his cats. He admits that last year he lost count of the Short-tailed Field Voles brought in!

The Water Vole *Arvicola terrestris* card contains easily the highest total of reports for any year since this particular editorship began in the mid-70s. It does seem that the species is continuing its long, slow recovery. Inevitably local variations occur. For instance, the Snettisham population seems to be considerably reduced. One was found dead in a garden there some 20 yards from the Ingol. It appeared to be in good condition and there was no visible cause of death.

Beeston Common, an old location for the black, melanistic, variant failed to produce this form when inspected this year and a further examination of the card shows that this is true of the other previously reported sites.

An unusual record comes from a Heron pellet found on the river bank on a spot where Herons are noted each year.

When the great autumn gale blew a poplar into the Tudd, the Water Voles there began to pull bark from the twigs and branches that were left above water. They continued the process until all available bark was stripped for several feet.

Woodmouse, Housemouse and Harvest Mouse are the featured animals in our series of distribution maps. We must emphasise that the dots represent reports from the marked squares thus leaving question marks on all the others and make no attempt to show relative numbers. So one mouse has the same pictorial importance as 100.

The Harvest Mouse *Micromys minutus* had a remarkable year and turned up in many new squares. Cats in South Wootton and Great Hockham supplied the evidence and in other places their distinctive summer nests gave away their presence. Owl pellets and a handful of actual sightings completed the list. One was found inside a plastic tube protecting a planted hawthorn on the fringe of the Norfolk Naturalists Trust Jubilee Wood project hard by the A47.

The Thurne mouth reed bed produced a record as did the green fields of Banham and Brooke. The unusually large number of reports tell us there is always the possibility of finding small mammals and we must never give up hope.

The cats at Hempnall evidently found the local Wood mice *Apodemus sylvaticus* less palatable than Field Voles, eating only half. One found in the kitchen may have been brought inside by an even less hungry hunter. Another kitchen in the same village houses an illusive Field mouse for a week before it was caught. Another fled into the owner's handbag when being pursued so, with the entire contents of the handbag, was unceremoniously dumped onto the doorstep.

Wood mice live in structured societies but individuals do step outside the normal pattern and take up unusual residence in sheltered situations, the sleeve of a 'mawkin' being a good example.

Bait put out to observe them in a Swaffham garden containing cheese, wild bird seed and melon seed proved highly successful. In November one of the Wood mice preceded the observer indoors and hid. When she stood quite still it came out to explore the room, investigated her shoes and finally stood on her feet to nibble the leather tags on her laces. (J.E.G.)

There were no records of the Yellow-necked mouse *Apodemus flavicollis*. The House mouse *Mus musculus* was also reported from a few more localities during the year. No large colonies were reported but "a few made a nuisance of themselves" at East Tuddenham. An enterprising individual at Kilverstone Zoo shared a cage with a more exotic exhibit, dashing out from a hole under a radiator to snatch items of food.

At Barnham Broome a House mouse lived happily in the greenhouse until, too adventurous or awkward, it drowned itself in the watering can. Those at Wroxham also appear accident-prone. One fell into the dustbin and another had a foolish tendency to leave its tail outside the hiding place when seeking shelter.

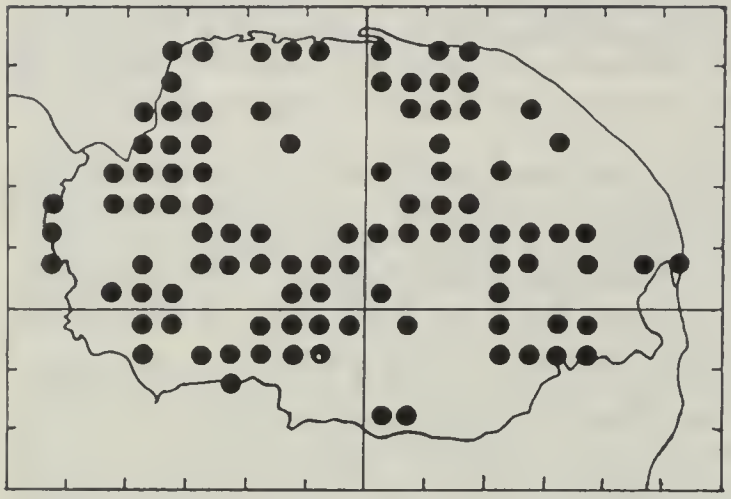
Against all these our Watton correspondent says that for the first time ever he did not see a single specimen all year.

Brown rats *Rattus norvegicus* were once common on Breydon, but are now seen far less frequently. At two mid-county sites they were frequent early in the year but scarce later. It does depend on local circumstances for one Edgefield source says they were very abundant. Present — but not many — from Corpusty strikes a reasonable balance!

The problems of early 1988 in West Norfolk are not anticipated in any 1987

Three Mouse Species in Norfolk

5km square distribution maps based on information received from contributors to the Mammal Report, 1974 to 1987.



a) Wood Mouse
Apodemus sylvaticus

b) Harvest Mouse
Micromys minutus

c) House Mouse
Mus musculus

reports. We hope to receive enough information to document the large numbers found in spring '88 in the next annual edition.

A Snettisham colony exemplifies the cunning and adaptability of the species. Three baits were left untouched but a pheasant hanging from a string in the shed was attacked by "a trapeze artist rat" that travelled along the rafter and down the string to de-crop the bird and probably feed from the grain still contained there.

One large rat seen by the public waste tip in Norwich was just where we would expect to find it. The riverside walk nearer the city centre seems a less likely location till we look round to see the rough ground and maze of old and new buildings, footings and foundations nearby.

CARNIVORA

How much depends upon the pure chance of being in the right place at the right time? One contributor who needs must make many night-time journeys has never seen a fox *Vulpes vulpes* crossing the road in fourteen years. For others its become almost a routine occurrence. Along the western fringe of the greater Norwich area, Hellesdon and Costessey both seem to be well populated from the reports that have come in and travellers' tales of sightings at night. Seen at Horsey Mere, abundant in Breckland and a growing problem at Breydon where their impact on other species has already been mentioned.

A strange tale is of an excellent view of a fox sunning itself only 20 metres or so away from the carcase of a dead one shot some two weeks previously. It would appear that the deterrent effect has been over-rated!

Information passed on from a keeper says there were no earths in Fox's Covert at Hockham for the first time in 25 years. The new by-pass cuts through that part of the wood. The site will be watched with great interest to see what happens in the future.

At Little Lodge Farm a fox was seen to play with dried leaves in the wind and then take itself off to sit on a tree stump and watch the traffic passing along the Brandon Road.

Otters *Lutra lutra* proved either extremely elusive or very scarce during the year. Only three reports were received and one of them from the Waveney was only a possible identification after a road death. Very definite was the footprint found at the other end of the county which had picture-book clarity. The increasing threat of encroachment and disturbance of otter territories is of great concern. It is a problem that is bound to become more and more severe as the population of our region grows at such a rapid rate and more developments push out into the relative wild.

Badgers *Meles meles* are not so far ranging though they still demand their specialist habitat for feeding and constructing their setts. Intensive land management is not badger-friendly. In spite of all, we continue to include the species on our list. One of the best monitored setts in the mid-Norfolk group showed much activity for most of the year 1987. During late autumn all the sett entrances were blocked, presumably by earth-stoppers of the local hunt. By the end of the year only four had been re-opened. Spring saw work gradually resume and by the 1st March 1988 all the entrances had been cleared.

The stoat *Mustela erminea* is, as usual, the most frequently recorded carnivore and anecdotes abound. One crossed the road at Hillington in July carrying a small hairless creature, an item of prey or young being moved to another situation. Stoats are normally born in April and May.

Stories are often told of stoats' persistence and determination in taking prey and

dragging it to their young or suitable cover. Its not always so. A vole was dropped in front of a cyclist at Holme and during June one of the guardians of the Stilts there saw a stoat kill a young rabbit after a long chase. Half-way up the sloping bank two very large rabbits confronted the killer which dropped its burden and took flight, chased by the two belated minders. A female stoat foraging in the dense grassland to the west of Norwich failed to penetrate one of the tussocks, rolled over on her back to rest awhile before resuming her hunt. At Barningham in October one was seen sporting a white collar but Brisley, Hockham, Wood Rising and Bradenham saw individuals in ermine.

An interesting set of notes from the Sweet Briar Meadows area outside Norwich have been submitted, including an account of a Weasel *Mustela nivalis* carrying a dead duckling in its mouth. After several attempts to by-pass the observer standing on the disused railway line, it dropped its prey and moved off. After examination, the duckling was left on the track and the Weasel nipped back to carry it off.

A sad tale from Edgefield where a Weasel circling the lawn was found to have a fractured skull. The cause was unknown but it could have been a traffic accident. More mysterious was the dead Weasel found on paving stones at Hardingham in October three days after the great storm, that most significant reference point of the year. No damage could be found on the body.

Tracks of both Weasel and Stoat were found in the snow at Belton early in the year. Both species appear to have gone on to a very successful season.

An American Mink *Mustela vison* was seen on the embankment beside the railway a mile outside Norwich on the Wymondham line. The Wensum at Ringland provided two observations on the same September morning for a correspondent who visits the area regularly. He saw Mink there nearly a decade ago but never since. The few references that come in suggest a small population along that river which make very little impact.

We hope to be able to publish a fuller account of Mink in Norfolk in a future edition of this report.

CETACEA

Common Porpoises *Phocoena phocoena* were seen off Holme in September and Hunstanton in February, August and October. All these were ones and twos but three were seen north of Scolt on 17th July. Records show a steady decline in sightings over the years which surely reflects the state of all cetaceans and not just this species. This statement is not negated by the fact that the first Common Dolphin *Delphinus delphis* on the card for several years was reported from Scolt Head on 10th September.

The standard of observation on the other hand continues to rise and this is exemplified by the report of two Pilot Whales *Globicephala melaena* seen off Paston 23rd September. The report include a full description of all the diagnostic features of the animals and compares them with a check list of all likely alternatives. There can be no doubt over the final decision and the whole is a model of careful recording.

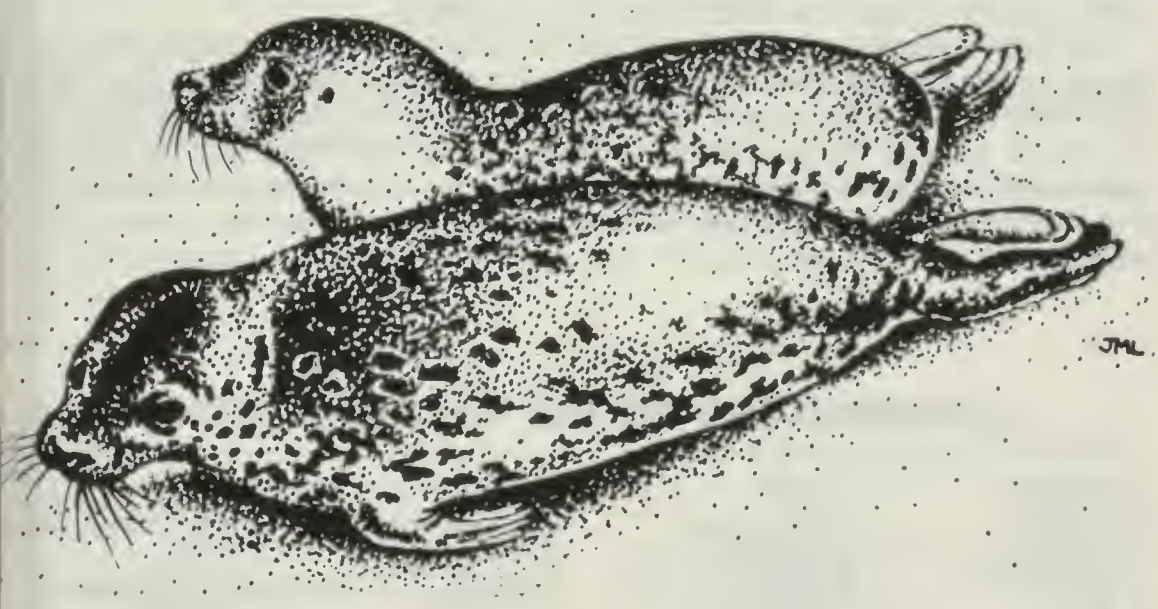
PINNIPEDIA

Common Seals *Phoca vitulina* popped up to add interest to the days when bird-watchers and walkers were visiting coastal reserves. It is often a story of mutual in-

cerest and curiosity. Holme, Thornham, Titchwell, Blakeney and the odd one at Scolt all featured in such incidents. Two very similar sightings occurred well inland. Buckenham is about 16 miles from the sea. On the 21st November a seal was watched for some time as it basked on the opposite river bank. The sighting was confirmed by another couple who had been out looking for Bean Geese, but instead spent about an hour watching what must have been the same animal.

Brandon Stanch, where the river and boundary twist and turn, is just inside the county. It was there that a very close encounter took place between a seal matching the 'photofit' and the observer who first thought it was a skin diver as it broke surface. The dogs accompanying her totally ignored it.

Common Seals continued to live up to their name round our coast. Grey Seals *Halichoerus grypus* inevitably had to contend with their now regular major problems. There were seen off the east coast, Thornham Point, Morston and one was found dead at Titchwell. The 28 at Horsey on the 21st April were the "most I've seen there for years". (PA)



ARTIODACTYLA

Whilst the main herd of Red deer *Cervus elaphus* maintains itself in Thetford Forest and should continue to do so, the focus of attention has turned to the northern, Wensum Forests, whence more frequent sightings are being reported. As the small groups of deer move from place to place in a more densely populated district they are more likely to be noted.

The star must be a 12-pointer seen for a moment near Edgefield. Hickling has had its small herd for some time and it was on 30th March that they were seen to have returned. A hind with two juveniles were observed in July. If they are left unharrassed their future looks to be set fair.

Fallow deer *Dama dama* left signs of their foraging in the Sandringham — West Newton woods and Dersingham Bog produced a much larger beast than the elusive micro moth.

A 'beautiful beast' left a startled driver no time to brake when a doe leapt across the road within the Western Forests and missed his car by a mere 10 feet. Deer and drivers are fortunate we have so few actual contacts.

Roe deer *Capreolus capreolus* fill their record card most completely and is is a fair indication of relative numbers. Thetford Forest and many sectors of Wensum Forest hold what is probably their full quota though few beasts are seen by casual visitors. Most records come, in fact, from deer straying outside their expected areas. One such was the individual just outside the boundary of East Dereham. Another was the single Roe deer seen in the very centre of Drayton during a pre-Christmas Saturday shopping morning. In spite of the busy crowds very few people noticed it!

The usual modest return was received on Chinese Water deer *Hydropotes inermis* though the card is slightly fuller than the norm. The most impressive group was at Catfield where 12 were found together on wheat stubble.

Two deer swimming in Cockshoot Broad gave a visiting party cause for excitement and on the Wheatfen — Rockland Marshes at 4 o'clock on a bright May afternoon the fleeting glimpse of a disappearing deer lead to the discovery of numerous small paths running through the reeds by fen/carr woodland.

A Muntjac *Muntiacus reevesi* was seen in Lingwood village moving from one garden to another. Another was noted on Belton Marshes for the first time. Thetford Naturalists' Society records show relatively few in the summer when most people are out walking. Perhaps too many people are out and about and the deer feel more settled during the quieter seasons. Whatever the reason, there is no doubt that this, our tiniest deer, continues to increase in numbers and to become more widespread.

CONTRIBUTORS TO THE MAMMAL REPORT

P. R. ALLARD
R. ANDREWS
M. J. BARRETT
J. BARTLETT
P. BENNINGTON
E. F. BOOSEY
W. BOOTH
A. BRADSHAW
D. BROWN
M. A. BREWSTER
A. BULL
J. BUTCHER
W. and R. CALLADINE
B. CAMPBELL
C. CAMPBELL
S. CHAMBERLIN
C. E. CLARKE
M. CLARKE
D. COKER
M. COLMAN
D. COTT
C. DACK
J. DAWSON
K. DOBSON
A. le F. DOBSON
D. and M. DORLING
O. G. DOUGLASS
B. DURRANT
K. DURRANT
Y. S. DUTTON
P. EYLES
D. FAGG
F. and C. FARROW
I. FARROW
H. FINCHAM
M. FISZER
R. FRANCIS
D. FOYSTER
T. FUTTER
J. E. GAFFNEY
J. and B. GALE
J. and J. GEESON
N. GIBBONS
J. GOLDSMITH
W. and K. GOOD
MRS. GORICK
R. HADMAN
R. and B. HANCY
VEN. A. M. HANDLEY
P. HARDIE
A. HARRIS
P. J. HEATH
A. HORSEFIELD
E. HOYOS
A. HUNT
D. and J. JERMANY
E. JERMANY
G. JESSUP
R. JONES
S and G. JUDD
P. KEELER
G. I. KELLY
J. and B. KENWOOD
M. KETT
DR. I. F. and MRS. J. KEYMER
J. G. KINSLEY
S. KNIGHTS
J. LAST
DR. R. M. LEANEY
D. LESTER
M. METCALFE
M. MITCHELL
D. MOORE
D., V. and B. MORGAN
D. MUSSELL
C. NEALE
Norfolk Young Naturalists
S. PARTRIDGE
D. and P. PASHLEY
MRS. PILE
S. and T. PLANT
R., P. and E. POLS
G. POLLARD
V. POTTER
M. POULTON
M. PUGH
J. L. RAINCOCK
H. RAMSAY
M. READ
G. REEDER
F. J. P. REYNOLDS
D. I. and R. M. RICHMOND
K. RIVETT
D. ROBINSON
R. and J. ROBINSON
A. ROGERSON
K. SAUL
G. J. SHERINGHAM
D. SHIPP
D. SHOWLER
V. SILLIS
I. J. SIMPER
C. J. SMALL
M. SMITH
S. SPOONER
M. STEVENS
R. STEVENSON
D. TATAM
Thetford Natural History Society
J. TRIMINGHAM
R. WALBY
K. WALTON
R. WHITTA
R. WRIGHT
Young Ornithologists Club (Norwich Branch)

NORFOLK & NORWICH NATURALISTS SOCIETY (Reg. Charity No.291604)

Patron: Her Majesty the Queen

The County's senior natural history society. It has for its principal objectives the practical study of natural science, the conservation of wild life, the publication of papers on natural history, especially those related to the county of Norfolk, arranging lectures and meetings and the promotion of active fieldwork. Specialist Groups cover most aspects of the county's flora and fauna.

Annual Subscription Rates:
Junior £3.00
Ordinary £6.00
Family £7.50
Affiliation £15.00

Secretary:
A. L. Bull
Hillcrest
East Tuddenham
Dereham NR20 3JJ.

Publications:
May: Transactions
August: Bird & Mammal Report
Quarterly newsletter 'Natterjack'

Membership Secretary:
C. Dack
12 Shipdham Road
Toftwood
Dereham NR19 1JJ.

NORFOLK ORNITHOLOGISTS ASSOCIATION (Reg. Charity No.267670)

for Birds and Bird-watchers

The N.O.A. was established in 1970 to act as a parent body to Holme Bird Observatory (Est. 1962), to further knowledge of ornithology, especially migration, to conserve habitats and disseminate knowledge of natural history through its wardens and reports.

Our Reserves are:

Holme Bird Observatory
By agreement & Purchase. Full-time Warden. 289 species seen in area 381 species of moths recorded.

Walsey Hills Information Centre & Migration Watch Point
Originally est. 1949. Purchased 1973. A vital migration watch-point. Seasonal Warden.

Holme Marsh Bird Reserve
Est. 1976. By agreement. 90 acres of relict grazing for waders & wildfowl. Part-time & voluntary wardening.

The Quags, Kelling
A 14 acre rough grazing marsh with pool purchased 1984. Passage and resident waders.

Redwell Marsh, Holme
A 35 acre wetland pasture purchased 1985.

Annual Subscription rates:
Individual £8.00
Husband/wife £11.00
Family £12.00
Junior £4.00
Single Life Membership £125.00

Members receive: free permits to our reserves, free N.O.A. Annual Report (pub. March), free Norfolk Bird & Mammal Report (pub. Aug.) and 2 News Bulletins.
Address: Norfolk Ornithologists Association (Office), Aslack Way, Holme next Sea, Hunstanton, Norfolk, PE36 6LP.

Printed in England by Witley Press Ltd , Hunstanton, Norfolk.

BRITISH MUSEUM
(NATURAL HISTORY)
- 2 AUG 1989
EXCHANGED
GENERAL LIBRARY

TRANSACTIONS
of
THE NORFOLK & NORWICH NATURALISTS' SOCIETY

Vol. 28 Part 3 July 1989

TRANSACTIONS OF THE NORFOLK AND NORWICH NATURALISTS' SOCIETY

ISSN 0375 7226 Volume 28 Part 3 (July 1989) Editor A. G. Irwin

OFFICERS OF THE SOCIETY 1988-1989

President: R. E. Evans

Vice-Presidents: Dr. R. Baker, P. R. Banham, A. L. Bull, K. B. Clarke, E. T. Daniels, D. A. Dorling, K. C. Durrant, R. Jones, Mrs J. Robinson, M. J. Seago, E. L. Swann, F. J. Taylor-Page

Chairman:K. C. Durrant, 18 The Avenue, Sheringham
Secretary:A. L. Bull, "Hillcrest", East Tuddenham, Dereham NR20 3JJ
Asst. Secretary: Mrs J. Negal, "Inishmore", Newton Flotman
Treasurer: D. A. Dorling, 6 New Road, Hethersett, Norwich NR9 3HH
Asst. Treasurer: M. J. Woolner, 45 Gurney Road, Norwich NR5 0HH
Membership Committee: R. Hancy (*Chairman*), C. Dack (*Secretary*)
Programme Committee: R. Robinson (*Chairman*), Miss D. Robinson (*Secretary*)
Publications Committee: R. Jones (*Chairman*), Dr A. G. Irwin, M. J. Seago, R. Hancy
Research Committee: P. R. Banham (*Chairman*), A. J. Parr (*Secretary*)
Hon. Auditor: J. E. Timbers, The Nook, Barford.

Elected Members of Council:
(Retiring 1989) D. A. Fagg, J. G. Goldsmith, Mrs P. Hardie, M. Poulton
(Retiring 1990) Mrs M. Cooper, E. Cross, N. Gibbons, M. Smith
(Retiring 1991) Mrs A. Brewster, M. Ewles, Mrs C. Haines, B. L. Sage
Co-opted and Representative Members of Council:
Dr Irwin (*Museum*) serves as an officer: Dr W. Sutherland (*University*)
R. Hobbs (*Norfolk Naturalists Trust*), P. Wright (*Nature Conservancy Council*)

SPECIALISTS AND ORGANISERS OF SPECIALIST GROUPS

Birds (Editor of the Report):
M. J. Seago, 33 Acacia Road, Thorpe St Andrew, Norwich NR7 0PP
Mammals (Editor of the Report):
R. Hancy, 124 Fakenham Road, Taverham NR8 6QH
Bats: J. G. Goldsmith, Castle Museum, Norwich NR1 3JU
Amphibia & Reptiles: J. Buckley, 22 Aurania Avenue, Norwich
Higher Plants: A. L. Bull, "Hillcrest", East Tuddenham, Dereham (East Norfolk)
Mrs G. Beckett, Bramley Cottage, Stanhoe, King's Lynn PE31 8QF (West Norfolk)
Mosses & Liverworts: C. R. Stevenson, 111 Wootton Road, King's Lynn
Algae: K. B. Clarke, Decoy House, Browston, Great Yarmouth
Fungi: R. E. Evans, "Chanterelle", Church Road, Welborne, Dereham
Insects: K. C. Durrant, 18 The Avenue, Sheringham NR26 8DG
Mollusca:R. E. Baker, 25 Southern Reach, Mulbarton NR14 8BU
Marine: P. R. Banham, Field Study Centre, Polka Road, Wells-next-the-Sea
Freshwater: R. J. Driscoll, Castle Museum, Norwich NR1 3JU
Photography: R. Robinson, 5 Southern Reach, Mulbarton NR14 8BU

FRONT COVER: The raft spider *Dolomedes fimbriatus* on bog myrtle *Myrica gale* (see p.233) — *R. E. Jones*

BRITISH MUSEUM
(NATURAL HISTORY)
- 2 AUG 1989
EXCHANGED
GENERAL LIBRARY

NATURE'S CURIOSITIES

THE PRESIDENTIAL ADDRESS DELIVERED TO THE SOCIETY ON 26 OCTOBER 1988

R.E. Evans

'Chanterelle', Church Road, Welborne, Dereham, Norfolk.

Ladies and Gentlemen -

I have chosen to speak to you on nature's curiosities in the hope that the subject will provide something of interest to everyone.

Spider behaviour

Some years ago I became interested in spider behaviour and in the parasites that plague them and their eggsacs. It is obvious that spiders often go to great lengths to protect their eggs, wrapping them in silk, and hiding the sacs in leaves, under stones and bark.

A series of experiments with the common spider *Enoplognatha ovata* was arranged to test the care she takes with her eggsac. A rolled-up leaf containing a spider and her eggsac was removed from a plant and suspended in a jar for several days. She seemed undisturbed by the change only leaving the leaf at night and returning by the morning. This could be seen in the tell-tale threads in the container. The leaf was then lowered to the base and left there overnight, when by morning she had taken herself and eggsac to the container lid. It would seem to be a precaution against crawling predators or flooding (Fig. 1). A similar leaf containing eggsac and spider suspended in a jar as before was uneventful until a small quantity of water was introduced. Overnight she removed herself and eggsac to the lid. High humidity is clearly disturbing to her (Fig. 2).

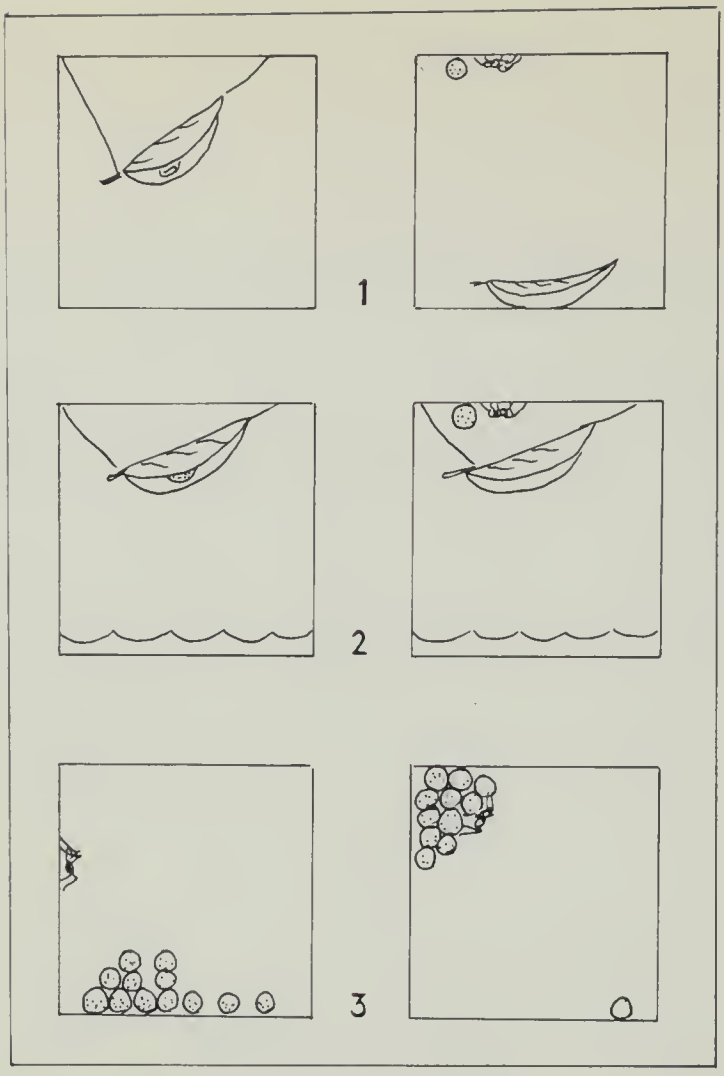
How well is she able to recognise her own eggsac? The eggsac of another species, a ball of silk made from a caterpillar cocoon, and her own eggsac were placed in a jar and the spider introduced. Her own sac is pale blue whilst the others were of a different colour. She took all three to the lid of the container, soon discarding the caterpillar silk, which was found in the base. The other eggsac was doubtfully accepted—since spider eggsacs tend to cling together and it may have been this adhesion rather than acceptance!

However she could hardly have been unaware of twelve eggsacs, and she does have the ability to detach her eggsac from retaining threads as we have seen in its removal from a leaf. Twelve eggsacs of this species (including her own) were placed in a jar and the spider introduced. Overnight she had taken eleven to the top and by the next day she had the dozen together, although it must be said that the load had slipped to halfway down the jar (Fig. 3).

If her eggsac is placed on the bottom of a jar and covered with a few similar size polystyrene balls she has no difficulty in locating and removing it to the lid—the polystyrene balls are ignored. The maternal care she displays for her eggsac is phenomenal, and she is quite prepared to take over any others supplied if they are the same species.

The common spider *Nucteana umbratica* is perhaps not the most beautiful of her kind. She is black with a faint 'leaf' pattern on the back of her abdomen. Her flattened shape enables her to hide in crevices during the day. She is one of the spiders that makes a number of eggsacs during her life and it would appear that one mating or more is sufficient to enable her to produce eggsacs at roughly six

Trans. Norfolk Norwich Nat. Soc.
1989 **28**(3), 169-174.



Figs. 1-3 Spider behaviour. See text for explanation.

week intervals over a period of 15 months without further mating. One such spider taken into captivity in March produced seven batches by May the following year when she died. Perhaps she could have laid another eggsac as she was apparently well nourished.

The spider *Dysdera crocata* must surely vie with *Nucteana umbratica* (at least to human eyes) as singularly unattractive. Fairly common she has a reddish cephalothorax (forepart) and a pinkish tubular abdomen. Her large forward pointing chelicerae (jaws) are said to be able to penetrate our skin. I have never tried to find out if this is so! One female was placed in a small container and a male

introduced. The size of the male is roughly the same as that of the female. The male ran over to the female and their legs interlocked. There was every appearance that a most bloody battle was taking place. A hasty search for implements to separate them was abandoned when it was seen that mating was taking place and repeated several times during the day. When they separated the male was not attacked by the female or harmed.

A small container with the green spider (*Araniella cucubitina*) and its young spiderlings were kept for study. After a week or so a dead fly's dessicated remains were left from a previous feed. A live fly was introduced and caused considerable disturbance. The spider was seen to attempt to catch the fly, missed and in error seized the dried remains. She administered a poisonous bite and then proceeded to wrap it in silk threads. She had been caught in a sequence of reflex actions over which she had no control but let us not assume that she is incapable of adjusting to a new set of circumstances.

Many years ago a large garden spider *Araneus diadematus* retreated behind fencing boards when offered a stunned (but moving) fly on a pair of tweezers. With a great deal of patience she was taught to recognise a tap on the boards as indicating food, when she would come out from her retreat and take the fly from the tweezers. Unhappily one day she had left the retreat and the experiment came to an abrupt end.

In nature total protection is virtually impossible and spiders have many parasites and predators to fear. This was revealed in searching for spiders in the crevices of fencing boards. On occasions small larvae were seen moving within the eggsac and were later identified as *Megeselia pulicaria*, a small fly which under different circumstances would provide a ready meal for spiders.

She lays her eggs on the outside of the cocoon and on hatching the larvae make their way to the eggs on which they feed. If there are more eggs than the larvae can consume then some young spiders emerge, otherwise the eggsac contains empty egg shells, empty pupa cases and emerging flies. In a paper on this subject (Evans, 1969) I questioned as to whether another fly *Megeselia nasonii* was also involved since its pupae had been found close to but not inside spider eggsacs. Some years later collections from Wayland Wood, Norfolk gave proof to this conjecture (Disney & Evans, 1980). Both fly species had not previously been recorded as parasites of spider egg sacs. It is curious that I have also reared *Megaselia pulicaria* from decaying fungi. This might indicate a possible movement to a predatory lifestyle, or perhaps different habitats for their young are chosen by varieties within the same species.

Spore dispersal

In considering the dispersal of seeds I understand that well grown plants of the following produce very large numbers of seeds: poppy 17,000, ragwort 63,000, bee orchid 10,000 per fruit, whilst the flower heads of rhododendron each produce 7,000 seeds. These are insignificant compared with a 4 inch (cap size) toadstool dispersing 15,000 million spores, or a bracket fungus producing 5.4 trillion spores over a period of six months. This profligacy in spore production enables the fungus to find special and curious habitats by dispersal over wide areas.

Those fungi we find characteristic of bonfire sites have arrived from sites which are likely to be considerable distances away. The need for super abundance of spores is necessary so that a few may reproduce. The remaining millions of spores falling 'on stony' ground are expendable. A survey of the fungi of a county is in consequence

really a survey of the fruiting bodies (the toadstools) and can give little account of the fungus living in wood or earth and not producing visible 'toadstools'. In spite of these difficulties, a long survey will give some indication as to frequency or rarity of these fruiting bodies and the habitat in which species are to be found.

This ability for using strange habitats is a character of a toadstool known as *Hebeloma radicosum*. Some call this the mole nest finder since it often appears above the animal's tunnels, especially where the droppings occur. It utilises the material which is rich in insect and worm remains.

Another fungus, *Tephrocybe mephitica*, is a small grey toadstool first found in this country in Hampshire growing on experimental plots in plantations of *Pinus sylvestris* and *Pseudotsuga menziesii* which had been treated with sodium and potassium carbonate solutions (Khan & Hora, 1976). This alkaline area would not be duplicated easily by nature, one might presume.

However in my pursuit of Diptera and Hymenoptera emerging from rotting fungi I collected a large yellow toadstool, *Russula claroflava*, from East Winch Common, an equally large white toadstool *Lactarius vellereus*, from Felthorpe Woods, and a wood encrusting fungus, *Peniophora gigantea* from Lynford picnic site. These were placed in separate containers with sterile peat and the flies and their parasites collected when they emerged. The containers and contents were then put aside and forgotten for some weeks. Serendipity is the making of unexpected discoveries by accident and the following is an example. Casually examining the containers which were strong in ammonia in each case, toadstools of *Tephrocybe mephitica* were found. The rotting of the fungi had produced accidentally the correct conditions for the fruiting of this fungus. It is curious that the locations for the collected fungi are about 16-20 miles apart and spores must have been present on them. Although these are the second, third and fourth British records (Evans, 1985) the fungus living under the ground must be widespread. Perhaps it produces other kinds of spores beneath the soil and only erects its toadstools in alkaline conditions?

Corpse Finders

An even more unusual habitat is revealed in this group — fungi associated with buried animal remains. A Japanese professor has suggested that this relationship might help in the search for buried corpses. In the Far East, war graves could be found by the presence of these fungi.

Fly killers *Entomopthora* sp.

A number of dead flies can often be seen in summer and autumn clinging to tall grasses and other plants. These insects have swollen abdomens and between the segments an extruding greyish white crust. This produces spores which are shot off into the air. These fall on leaves etc. where they may well make contact with a fly. The spores are sticky and adhere to the victim, germinating to invade the insect's interior. As the fly dies it usually rests above the ground and is anchored there by fungal threads which often emerge through the proboscis.

Spore dispersal from a situation above the ground is a great advantage enabling greater distribution, and more likelihood of finding a victim. To ensure survival of the fungus species they have the ability to produce large thick walled resting spores within the host's interior (*Tarichium* spp.) These germinate when the conditions are suitable.

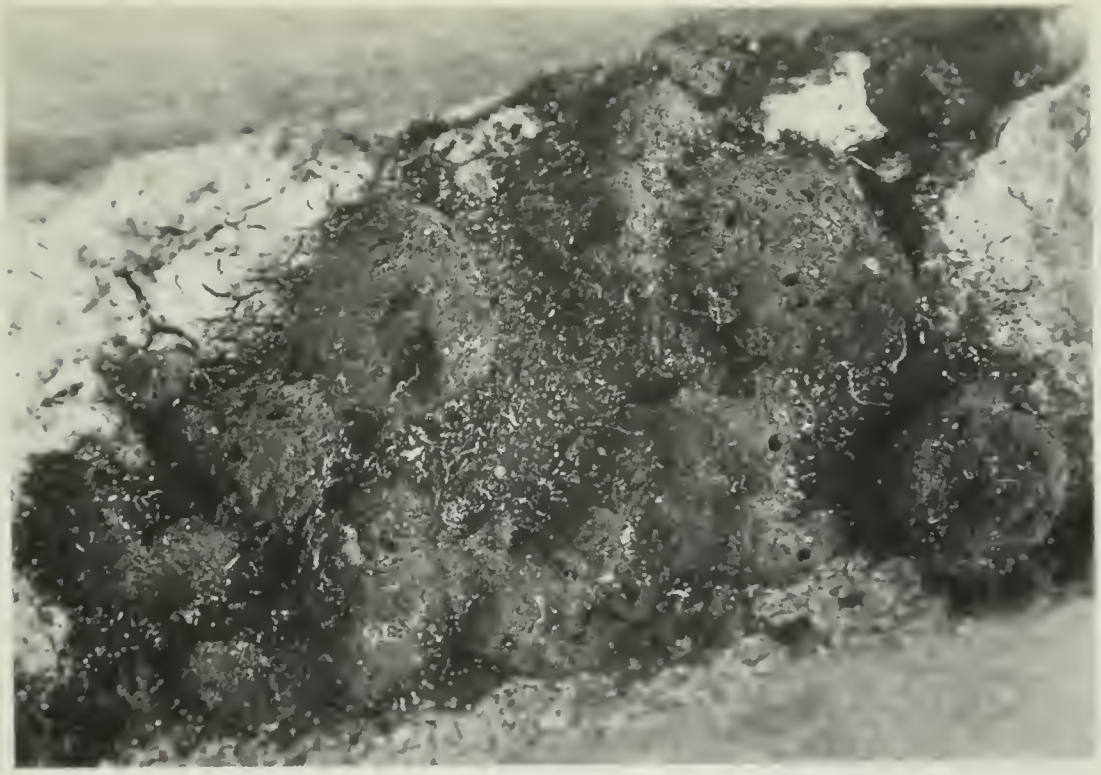


Fig. 4 Galls of *Brachyneurina peniophorae* on *Peniophora cinerea*.

Fig. 5
Pupal exuviae of *B. peniophorae*.

Caterpillar killers *Paecilomyces* sp.

Some other fungi specialise in attacking insects and often show some preference for certain species. Larvae of moths are infected as they descend from trees and shrubs to pupate in the ground. In their wanderings to find a suitable site they may be in contact with spores or fungal threads. These grow through the wall of the larva by means of an enzyme (chitinase) and ramify through the tissues, eventually occupying all the inside of the caterpillar or pupa. In due course white stems arise from the insect and these bear 'floury' heads of minute white spores which disperse to infect the area again. There will be years when the larvae are scarce and few become infected. Nevertheless the fungus is common in soil and leaf litter with its host.

This may seem a remarkable story but there is more! The parasitic fungus described above is *Paecilomyces farinosus*, and it is occasionally found parasitised by another fungus, *Melanospora parasitica*. This occurs as black "hairs" against the floury whiteness of the stems. Since it is dependent upon the *Paecilomyces* its survival is remarkable. It is presumed that dispersal is affected by attachment of its spores to those of its host since it does not appear to live independently.

Galls

There are no less than 14,750 different galls known on plants and 7,666 in central and northern Europe but only 6 have been recorded on fungi. The following report is an addition to that list.

The host is a bark encrusting fungus *Peniophora cinerea* and the gall producer a midge *Brachyneurina peniophorae*. The gall midge lays its eggs on the surface of the fungus, where on hatching they develop soft brown galls which soon enclose the larvae (Fig. 4). Emergence is effected by the pupae extruding from the gall (Fig. 5) and the midge emerges from it (Harris & Evans, 1979).

Recent collections in Norfolk indicate this new midge is widespread in damp areas, being seen in ten locations. Recently I have found galls of this species being produced on another fungal host, *Peniphora limitata*, on an ash branch. It has an associated parasitic wasp, *Tetrastichum vacuna* group nr. *thysanotus*.

You will note that in this talk fungi have been associated with bonfires, mole nests, caterpillars, flies, and gall midges, and this is but a small selection of habitats. I have been fortunate to unravel a few threads from the rich tapestry of nature. I am also profoundly aware how few those threads are and how much is yet to be discovered.

References

DISNEY, R. H. L. & EVANS, R. E. 1980 Phoridae (Diptera) whose larvae feed on eggs of spiders (Araneida). *Entomologist's mon. Mag.* **115**, 21-22.

EVANS, R.E. 1969 Parasites on spiders and their eggs. *Proc. Bgham nat. Hist. Soc.* **21**(3), 156-168

HARRIS, K. M. and EVANS, R. E. 1979 Gall development in the fungus *Peniophora cinerea* (Fr.) Cooke induced by *Brachyneurina peniophorae* sp.n.(Dipt. Cecidomyiidae) *Entomologists Gazette* **30**(1), 23-30.

EVANS, R. E. 1985 A toadstool in an unusual habitat. *Bull. Br. mycol. Soc.* **19**(1), 60

KHAN, A. Z. M. N. A. & HORA, F.B. 1976 New British record of *Tephrocybe mephitica*. *Trans. Br. mycol. Soc.* **67**(2), 358-360.

FUNGAL INFECTION OF ALGAE IN THE BROADS

Keith Clarke

School of Environmental Sciences, University of East Anglia.

Abstract

Although fungal infection of algae is common in the Broads it has not previously been described. The purpose of the present paper is to indicate the extent of fungal infection and mention some of the more common occurences. The taxonomy of chytrid fungi is difficult and it has not been possible in every case to provide accurate identifications.

Infection of *Stephanodiscus hantzschii* f. *tenuis* by an unidentified chytrid in the River Bure and Malthouse Broad is described in detail.

Introduction

Very many samples of phytoplankton taken from the Broads contain algae which are infected with Phycomycetes ("algae-fungi"). These fungi, mostly chytrids, are never mentioned in works about the Broads. In view of their abundance it would seem possible that they play an important part in the ecology of broads' waters.

It is not uncommon to find that 30% of a population of algae are infected and as populations of algae often reach fifty million cells per litre there must be, at times an awful lot of chytrid fungi in the Broads.

In the course of examination of algae in the Broads over several years my notebooks contain many references to the presence of chytrid fungi. By going through these casual notes it is possible to get an overall view of the extent of fungal infection of algae observed in the Broads.

Many of the accounts of fungal epidemics have been in the laboratory or in waters which have a fairly low nutrient status. The classic work of Canter and Lund (1951) was undertaken in the English Lake District. It is interesting to compare their results with an epidemic in the hypertrophic tidal lake system of the River Bure where far more algae are present. Windermere has an annual chlorophyll 'a' maximum of 20-40 $\mu g\ l^{-1}$ (Talling & Heaney, 1988) while in the Bure Broads this figure is 200-400 $\mu g\ l^{-1}$ (Moss *et al.*, 1988), a tenfold difference.

Chytrid fungi are not difficult to see with the microscope, especially as they often contain refractile material which causes them to appear bright alongside the algae. It is possible to confuse some micro-flagellates with them but a little observation soon allows a distinction to be made. Observation is greatly helped by the use of a phase-contrast microscope. However, to provide reliable identification of chytrids is difficult. It requires a knowledge of much of the life-cycle of the specimen. Perhaps because of the richness of the environment for chytrids it has proved very difficult to obtain resting spores of most broadland specimens.

The life-cycle of the fungi is simple (Fig. 1). A motile spore attaches itself to the alga, drops its flagellar apparatus and puts down a root into the alga, digesting the cell contents. As it does so it grows in size and produces spores inside a sporangial sack. These spores are liberated and go off to infect other algae. Differing spores unite at times of population decline to produce thick-walled resting spores.

Araphid diatoms

In many of the Broads *Asterionella* can usually be met with, although it seldom reaches

Trans. Norfolk Norwich Nat. Soc.
1989 **28**(3), 175-182.

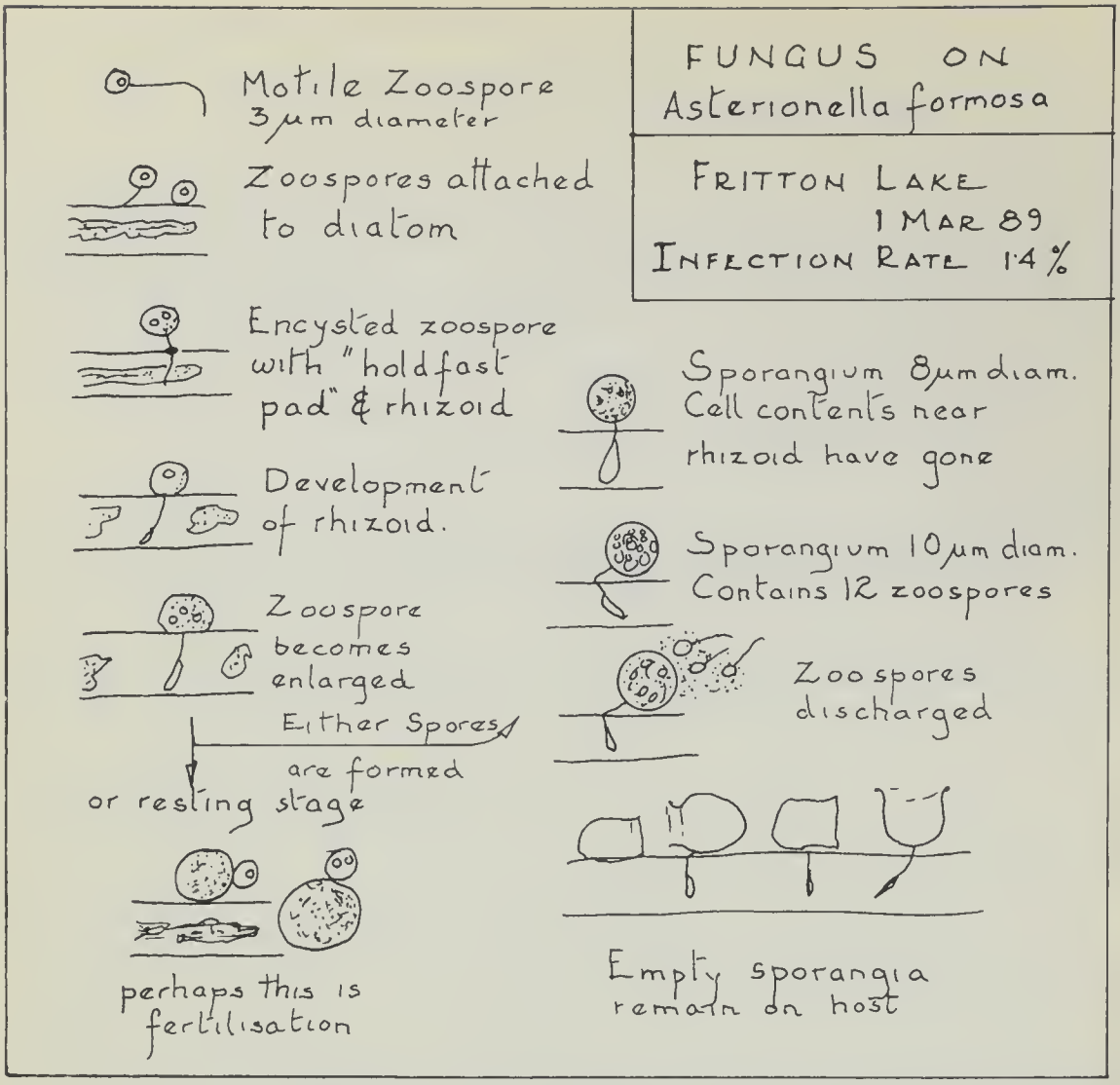


Fig. 1 Life cycle of a chytrid fungus. Notes on a chyrtrid infecting *Asterionella formosa* in the Broads.

the dominance found in the Lake District for instance. Very often it is in second, third or fourth place to centric diatoms, *Synedra*, or *Diatoma*.

The infection of *Asterionella formosa* Hass. in the Broads is mostly by *Rhizophydium planktonicum* Canter but a very similar fungus also causes infections (Fig. 1) and many of my earlier notes of *Rhizophydium planktonicum* may refer to this other chytrid. Canter has noted (Canter & Lund, 1948) that *R. planktonicum* is almost always present if the host is. Generally only about 5% of cells are infected. Epidemics where 90% are infected as in Windermere (Canter & Lund, 1951) have not been observed in the Broads. Also the numbers of encysted zoospores per cell is only one or two. Multiple infections seem to be much rarer in the Broads.

In the Broads, as in the Lake District, the population of *Asterionella* will persist for months with a fair proportion of infected cells.

The other two common araphid genera in the Broads, *Synedra* and *Diatoma*

Fig. 2 Chytrid sporangium on *Navicula rhynchocephala* from Woodbastwick.

do not suffer much from fungi. They are occasionally seen with sporangia or encysted zoospores but no epidemics, like the epidemic on *Synedra* reported in Holstein (Holfeld, in press), have been observed in the Broads.

Raphid Diatoms

Raphid diatoms are motile and anything growing on the outside is a restriction to their mobility. Nevertheless this seems to be the usual type of chytrid in raphid diatom infections and endoparasites have rarely been seen. Infections are usually of mud surface diatoms and generally less than 1% of the population is infected.

We may take as an example the infection of the diatom *Navicula rhynchocephala* Kuetzing which occurred in January 1987 in the dyke draining Breydon Carr, Woodbastwick into the River Bure 300 m downstream of Horning Ferry (grid ref. TG346163). In strong sunlight pieces of the mud surface had floated up to the water surface. Under the microscope several live *Navicula rhynchocephala* were found with a large pear-shaped sporangium (Fig. 2). They were still fully motile but the chromatophores were vague and appeared to be altered. In comparison with the diatom the sporangium is large: 20 μm long on a diatom 37.5 μm long. Because they are so large the sporangia tug the diatom over on its side and it is then possible to see the girdle view, an otherwise rare sight.

In the same material were cells of the diatom *Stephanodiscus hantzschii* f. *tenuis* Hustedt) Hakansson & Stoermer infected by a different chytrid.

More recently (27 December 1988) an almost identical case arose in a dyke on

Fig. 3 A large sporangium on the raphid diatom *Nitzschia sigmoidea*. Overall length of sporangium 50 μm.

Fig. 4 The sporangium detached from *Nitzchia sigmoidea* by pressure on cover slip.

Surlingham Church Marsh (TM309071). The infection rate was estimated at less than 1 in 10,000. It was however interesting that several detached sporangia were noticed in the material, one with a little of the rhizoid (?) attached. It has often been noticed that rough treatment of the samples can result in loss of sporangia and zoospores from the surface of the algae.

Infection by chytrids seems more common in the raphid diatoms of bottom mud associated with algal mats. Such mats occur in many broadland waters. Usually, though not always, the blue-green alga *Oscillatoria limosa* Agardh. is a feature of the algae making up the mat. These mats provide a sheltered habitat for diatoms. Without this protection the water turbulence might tend to remove the sporangia from the larger mud diatoms. In the laboratory it is easy to detach the sporangia. Fig. 3 shows a large sporangium on *Nitzachia sigmoidea* (Nitzsch) W. Sm. and Fig. 4 shows the sporangium detached from the diatom by currents caused by pressure on the cover glass.

In Salhouse Broad (TG320157) on 3 March 1987 pieces of *Oscillatoria limosa* mat were breaking loose at the mud surface in pieces about 20 mm across and drifting with a gentle east wind. There were about 40 diatom cells to one filament of *O. limosa.* The *Stephanodiscus* present, *S. hantzschii* f. *tenuis*, had 37.5% of the cells

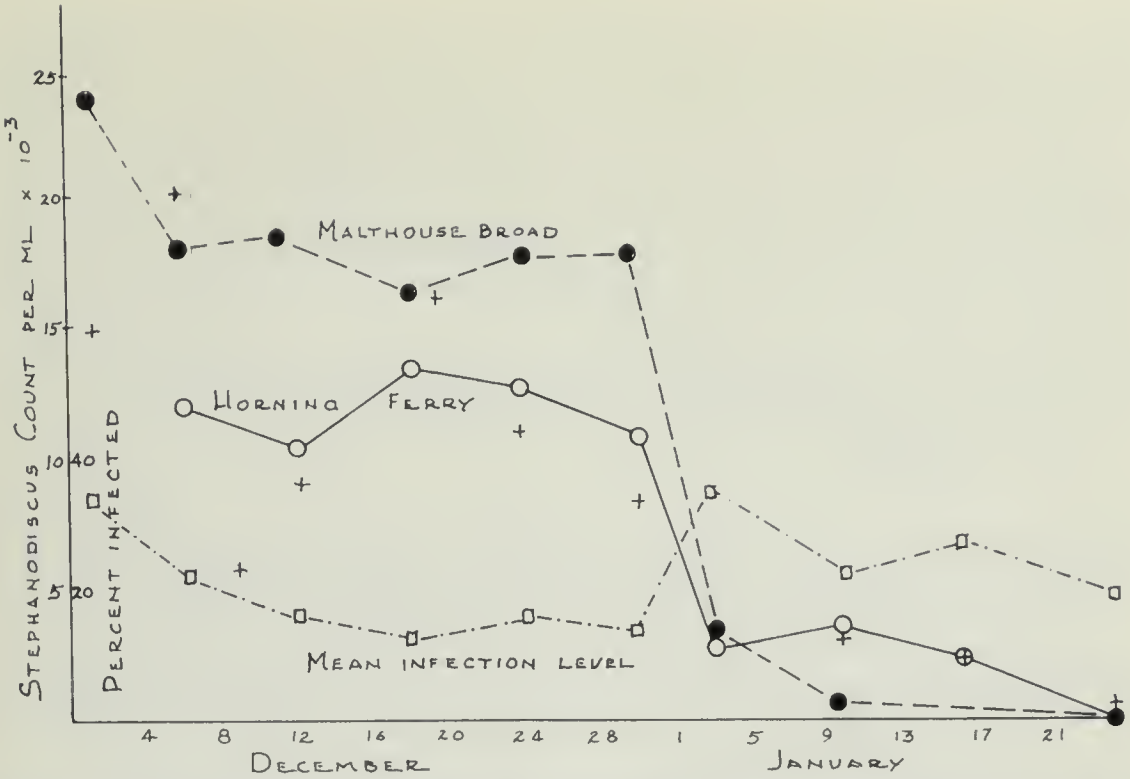


Fig. 5 Numbers of *Stephanodiscus hantzschii* f. *tenuis* in the River Bure at Horning Ferry and Malthouse Broad in the winter of 1986-7 showing also the extent of infection of the crop. Note the dramatic change which occurred in three days around 1 January. + indicates Horning Intake (Church Bend)

infected. Also infected by chytrids were *Nitzschia fonticola* Grunow, *Navicula rhynchocephala* and *Asterionella formosa.*

Centric Diatoms

The Bure and adjacent broads carry a chytrid population which affects the winter phytoplankton of *Stephanodiscus hantzschii* f. *tenuis.*

It was noticed on 24 Nov 1986 that 9% of a population of 23,000 cells per ml were infected, having encysted zoospores or sporangia on their outer surface. There were up to 4 sporangia per infected cell.

The population maintained itself in apparently stable condition with the infection for a month. It was widespread, affecting the tidal river Bure, the rivers Ant and Thurne and a tidal broad, Malthouse Broad, which is connected to the river by a channel 0.5 km long. (Sample sites at TG372171, TG420184, TG414117, TG344166, TG359164 and TG360147).

Quite suddenly, in the course of four days, the diatom population collapsed, numbers decreased and the infection rate rose (Fig. 5). In the broad the ratio of living to dead cells in the plankton fell dramatically. This change in the ratio was not noticeable in the river, in fact the ratio increased (Fig. 6). It must be borne in mind that there is considerable tidal movement in the river and it is almost impossible to sample the same water mass on successive occasions. The figure plotted is the lowest live:dead ratio on each occasion from the river samples.

After this fall in numbers the population began to recover gradually and the number of infected cells decreased. Perhaps the diatoms had achieved some degree

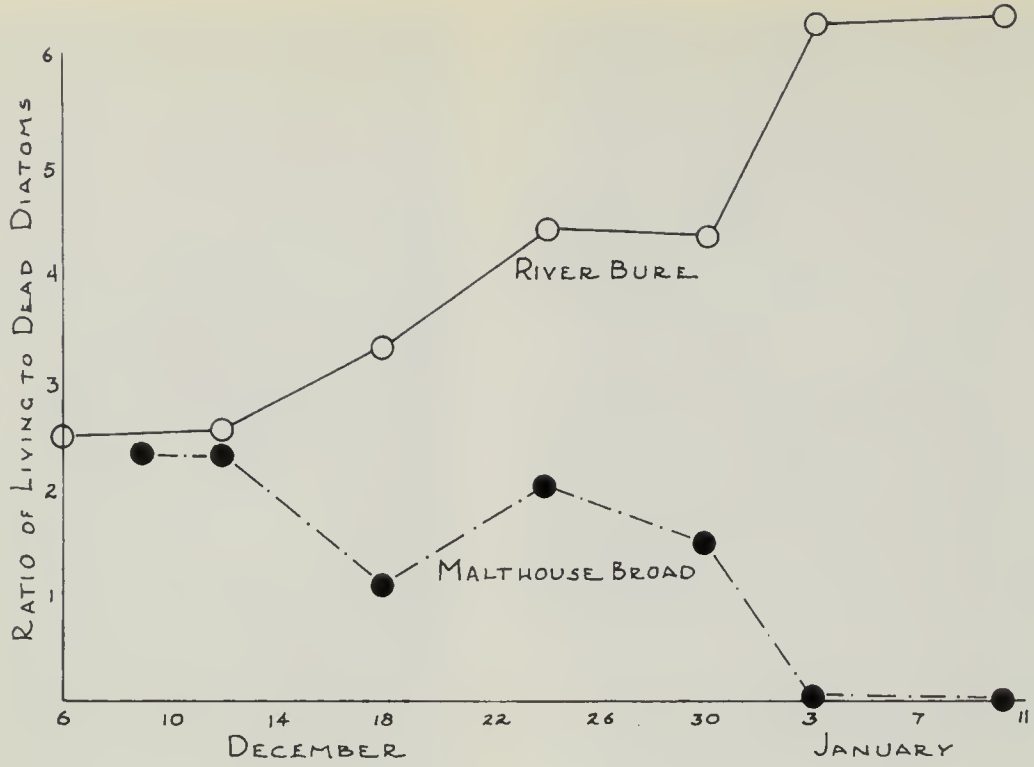


Fig. 6 Ratio of living to dead cells of *Stephanodiscus hantzschii* f. *tenuis* in the River Bure and Malthouse Broad in the winter of 1986-7. Note the difference between the river and the broad in response to the sudden decline of population around 1 January.

of immunity or they were too far apart for the infection to be successfully transmitted. The uniflagellate chytrid involved was itself attacked by a biflagellate hyperparasite right from the beginning of the epidemic. Dr Hilda Lund (née Canter) (*in litt.*) also pointed out to me that some of the diatoms contained an endoparasite which she provisionally placed in *Aphanomycopsis*.

In 1988 *S. hantzschii* f. *tenuis* was again attacked. On 10 March about 1% of a population of 61,170 cells per ml of *Stephanodiscus hantzschii* f. *tenuis* was affected. Again in November 1988 a population of this diatom, *Cyclotella stelligera* (*sensu* Howarth & Hurley, 1984) and *Asterionella formosa* Hassall was observed. Almost every *S. hantzschii* was infected but none of the *Cyclotella stelligera* or *Asterionella formosa*. The situation in Malthouse Broad was similar. Here two *C. stelligera* were found to be infected out of many hundreds examined and it is likely that infection was by another species of fungus.

A similar dramatic reduction to that in the Bure was made in water from Fritton Lake (TG480000) and Mill Water (TG500010) on a filter bed at Lound (TG501006) in June 1988. A chytrid with a uniflagellate zoospore about 1.5um diameter began to infect a large population of *Cyclotella stelligera*. Numbers in the plankton fell from 200,000 per ml to 10 per ml in five days (Clarke, 1988).

Isolation of broads from the river system does not seem to affect the magnitude and wealth of the chytrid flora. Cockshoot Broad (TG344155) has been isolated from the river Bure since 1982 by a dam in Cockshoot Dyke. A sample on 24 August 1988 showed that in the mixed population of *Cyclostephanos dubius* (Fricke) Round

and *Stephanodiscus parvus* Stoermer & Hakansson both were infected by a similar chytrid. The latter was suffering badly. Of 100 frustules 57 were dead, 31 were infected and only 12 were unaffected. This represents a 72% infection rate of living cells. Two infected *C. dubius* were seen.

The diatoms in Alderfen Broad (TG355195) on 13 July 1988 were similar. Here *Stephanodiscus parvus* was also heavily attacked but no infection was noted on *Cyclotella stelligera* which was much more common. It should be noted that the *S. parvus* in these broads is by no means typical and we may be dealing here with a different species.

The River Yare at Buckenham Ferry (TG350043) on 2 June 1987 had a plankton of *Stephanodiscus hantzschii* f. *tenuis*. Of 100 frustules counted 18 were dead, 35 were infected and 47 were uninfected (live infection rate 42.5%).

Green algae

In February 1989 the *Eudorina* in College Basin at Lound (TG499010) was infected with *Endocoenobium eudorinae* Ingold. This was the first opportunity I had had to study this fungus since reading a detailed account of it in Canter (1985)

This mild infection followed an interesting one of *Pandorina morum* Bory by *Dangeardia mammillata* Schroeder. Although much of the *Pandorina* was absolutely typical it was difficult to draw an absolute line between this genus and *Eudorina* which was also present. So far as one could say, both genera were infected by *Dangeardia mammillata*. This is not surprising as the species was first described on *Pandorina morum* (although Hood (1910) says that Schroeder's figure is of *Eudorina* elegans) and Canter's account (Canter, 1946) was of *Eudorina*. Pongratz (1966) pointed out the difficulty of distinguishing between these species.

The River Waveney on 6 May 1987 had a chytrid infection of *Chlamydomonas* which was moderately severe (50% infected). The alga is biflagellate and continued to move until the infection was very advanced. This same retention of motility was observed in Lound Village Pond (TM504992) where an endoparasite occupied about half the cell volume with its sporangium. The spores were already developed but the alga still moved. On keeping the sample for 24 hours however there were a lot of cast off flagella in the water.

Chrysophytes

Numbers of chrysophytes in the Broads are relatively small but in the Lound lakes they are often the dominant organism during winter and early spring. No infection of *Synura* has been seen but crops of *Dinobryon sertularia* Ehr become heavily infected at the time of formation of encysted individuals by the alga. Sparrow (1960) lists only one chytrid as having been reported from *Dinobryon*, *Rhizophydium oblongum* Canter. While a chytrid like this is present there are two further chytrids, an endoparasite forming a clear round sporangium and an ectoparasite with a spherical sporangium which appears to be slightly stalked and posessing a distinct and unbranched rhizoid.

Discussion

We have seen that fungal infection of algae in the Broads is widespread. It affects many kinds of algae and has been found in most of the waters examined. Numbers are very considerable. In view of this we should take into account the presence of

Phycomycetes in studying changes in numbers of algae in these waters. In doing this two important points need to be borne in mind.

Firstly, to what extent are the fungi affecting the growth of the population? Are they really parasitic or simply saprophytic, attacking cells which are already dead or dying? It is extremely difficult to say whether the fungi are killing the algae or not. Serbinow (1907) who studied a number of chytrid parasites of algae concluded that many of them were only faculative parasites. Each case needs to be examined on its merits. Certainly in most of the cases examined here the attacked populations looked healthy enough and were actively motile in the case of raphid diatoms and *Chlamydomonas*. It was also possible to find plenty of moribund algae in the material which were not the subject of attack.

Secondly, to what extent is the population reacting to infection? This seems to be an important question in the Broads. Canter & Lund (1951) pointed out that the most common effect of parasitism is to delay the time of maximum numbers of the algal crop. In the Broads, because of the hypertrophic situation and numbers of fungi present, it would seem that this delay is very long. Populations may come to live in a state of balance with the infection.

Acknowledgements

I have to record my gratitude to Dr Hilda Canter (Mrs J. W. G. Lund) for sending me a stream of publications and picture postcards over the years. This has been a pleasant way of learning a little about chytrids. I am also grateful to the directors and general manager of East Anglian Water Company for making it possible to use their very fine laboratory. Dr Brian Moss very kindly arranged for me to use the Hitachi S800 scanning electron microscope in the University of East Anglia for study of the diatoms involved.

References

CANTER, H. M. 1946 Studies on British chytrids. I. *Dangeardia mammillata* Schroeder. *Trans. Br. mycol Soc.* **29**, 128-134.

CANTER, H. M. 1985 Observations on the chytrid *Endocoenobium eudorinae* Ingold. *J. Linn. Soc (Bot.)* **91**, 95-116.

CANTER, H. M. & LUND, J. W. G. 1951 Studies on plankton parasites. I. Fluctuations in the numbers of *Asterionella formosa* Hass in relation to fungal epidemics. *New Phytol.* **47**, 238-261.

CANTER, H. M. & LUND, J. W. G 1951 Studies on plankton parasites III. Examples of the interaction between parasitism and other factors determining the growth of diatoms. *Ann. Bot. (New Series)* **15**, 359-371.

CLARKE, K. B. 1988 Some aspects of the filtration of water containing centric diatoms. In Graham, N. J. D. (Ed.) *Slow Sand Filtration.* Chichester: Ellis & Horwood.

HOLFIELD, H. (In press) Parasitic fungi on planktonic freshwater diatoms.*10th International Symposium on Living and Freshwater Diatoms.*

HOOD, O. 1910 On *Rhizophydium Eudorinae*, a new chytridaceous fungus. *Proc. Bgham nat. Hist. phil. Soc.*:**12**, 38-45.

MOSS, B., BALLS, H., BOOKER, E., MANSON, K., & TIMMS, M. 1988 Problems in the construction of a nutrient budget for the R. Bure and its Broads (Norfolk) prior to its restoration from eutrophication. In Round F. E. (Ed) *Algae and the Aquatic Environment.* Bristol: Biopress.

PONGRATZ, E. 1966 De quelques champignons parasites d'organismes planctoniques du Leman. *Revue suisse d'Hydrologie* **28**, 104-132.

SERBINOW, J. L. 1907 Studies of Phycomycetes. Organisation and life history of some chytrid fungi (Chytridinae Schroeter). *Scripta Bot. Horti Univ. Imper. Petro.* **24**, 1-173 (in Russian with German summary).

SPARROW, F. K. 1960 *Aquatic Phycomycetes* (2nd Ed.) Ann Arbor: University of Michigan Press.

TALLING, J. F. & HEANEY, S. I. 1988 Long Term changes in some English (Cumbrian) Lakes subjected to increased nutrient outputs. In Round, F. E. (Ed.) *Algae & the Aquatic Environment.* Bristol: Biopress.

THE LICHEN FLORA OF NORFOLK—SYSTEMATIC LIST

P. W. Lambley.

The Cottage, Elsing Road, Lyng, Norwich

Introduction

The first part of this paper (Lambley, 1988) discussed the historical and ecological aspects of the Norfolk lichen flora. This second part presents a systematic list of the species recorded from the county. Nomenclature follows Cannon, Hawksworth and Sherwood-Pike (1985). In cases where there have been later name changes the new name is placed after the checklist one.

Since the first part of the paper was published there have been a number of taxonomic changes and several new species have been discovered. The total of species and sub-species accepted for the county now stands at 352 plus 3 allied non-lichenized fungi. Of these, 31 have not been recorded since 1960.

Coverage

All 10 km squares in the county were visited at least once and generally at least five times during the period 1969-1984 and nearly all post 1960 records were made between these dates. Fig. 1 shows the number of species recorded from each of these squares. The uneven distribution largely reflects genuine differences in species richness within the area covered. The Fenland squares in particular stand out as being impoverished. The flat, treeless, intensively farmed land is a hostile environ-

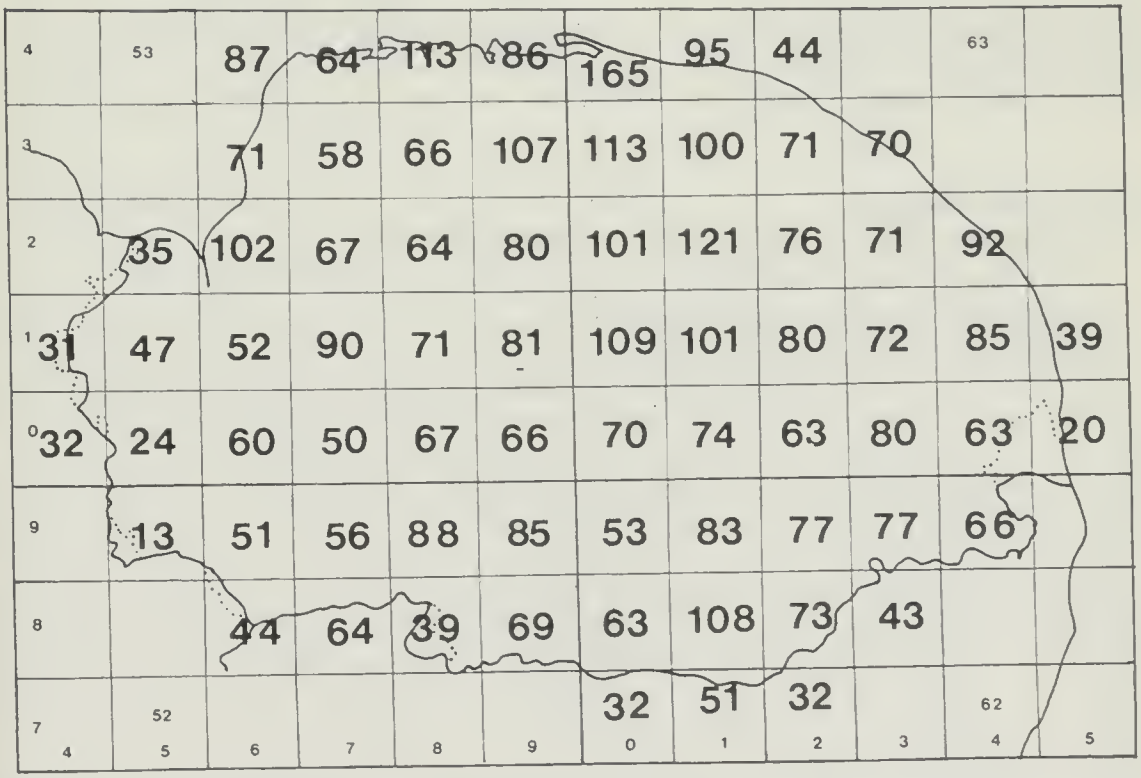


Fig. 1 Map of Norfolk showing the number of lichen species recorded from each 10 km square.

ment for lichens. One square (52/29) does not even have a churchyard of note. The north-west part of the county also includes areas which have few good lichen habitats. The square including Docking (53/73), for instance, is largely enclosed sheep walk with large fields, nineteenth century plantations and only four churchyards. In contrast, squares in the central northern part of the county are relatively rich with old woodlands, good coastal habitats and several important heaths. Two squares (63/01 and 62/18) were worked intensively as examples of squares which appear to be typical of many others in the centre and south of the county; both have no major habitats but do have a good number of churches (11 and 14 respectively). The totals of over one hundred are probably repeatable in many other squares, though in the Fens totals of over sixty might be hard to achieve.

Abbreviations—List of Recorders

B&B	Drs Dennis and R. Brown
PC	Peggy Caton
BJC	Dr Brian Coppins
JC	James Crowe
FD	Frank Dobson
EAE	Dr Edward Ellis
AF	Dr Anthony Fletcher
JGG	John Goldsmith
CJBH	Dr Christopher Hitch
EMH	E. M. Holmes
WJH	Sir William Hooker
PWJ	Peter James
K&W	Knight and Watson
PWL	Peter Lambley
RCM	R. C. McLean
FM	F. Mackie
SAM	Stanley Manning
AM	Anthony Moore
CJP&JP	Charles and James Paget
FR	Dr Francis Rose
MRDS	Dr Mark Seaward
JES	Sir James Smith
ELS	Eric Swann
TDVS	T. D. V. Swinscow
KT	Kirby Trimmer
DT	Dawson Turner
WW	W. Watson

Other abbreviations

*	species considered extinct (not recorded since 1960).
+	species considered doubtful or record known to be erroneous.
=	the name following is post checklist.
()	species within paranthesis are taxa believed not to be lichenized.
()	grid refs. in parenthesis refer to records up to and including 1960.
HbBM	Herbarium of the British Museum (Natural History).
HbE	Herbarium of the Royal Botanic Gardens, Edinburgh.
HbK	Herbarium of the Royal Botanic Gardens, Kew.
HbKL	Kings Lynn Museum Herbarium.
HbL	Herbarium of the Linnaean Society, London.
HbNWH	Norwich Castle Museum Herbarium.
HbSAM	Herbarium of S. A. Manning.
OBG	The Old Botanists Guide (Turner & Borrer, 1805).
Eng.Bot.	English Botany (Smith & Sowerby, 1790—1814).
VCH	Victoria County History (Crombie, 1901)
BLS	British Lichen Society.
NNNS	Norfolk and Norwich Naturalists' Society.
HWM	High Water Mark

SYSTEMATIC LIST

Acarospora fuscata: Common. On acid stonework, preferring horizontal surfaces like wall copings and table tombs. Usually in eutrophic situations. Recorded from 31 squares. 44.3%

53/40,51,63,64,70-72,74,81,83,84,91,92 52/79,99 63/00-04,11,14,20,33,40,41,50 62/08,09,18,19,49.

Acarospora heppii: Uncommon. On bones and shells on the coast.

53/84 Scolt Head Island on mussel shells in consolidated shingle PWJ 1959 HbBM, 63/04 Blakeney Point on bones and shells B&B.

Acarospora rufescens: Status unknown. Probably on a tombstone, but material was difficult to collect. The taxonomic status of this species is under review.

52/69 Southery Church PWL and CJBH 1984, 52/99 Great Hockham Church PWL and CJBH 1984.

Acarospora smaragdula: Apparently uncommon. On acid stone, coastal.

53/84 Scolt Head Island on flint in shingle PWL and AF 1983, 63/04 Blakeney Point on tiles B&B 1962.

Acarospora veronensis: Uncommon. On brickwork, limestone, also on shells.

53/84 Scolt Head Island on oyster shell PWJ 1964, 94 Lodge Marsh Wells on oyster shell PWL 1974, 52/99 Thompson Church on buttress PWL, 63/41 Acle Church on side of table tomb PWL, 62/49 Burgh St. Peter Church on brick buttress and limestone PWL 1975.

+Acrocordia conoidea: Recorded by K&W in 1934 from Hevingham (63/22). There is no supporting specimen and the record is considered doubtful.

Acrocordia gemmata: Uncommon. On ash, oak and elm in parkland and woodland.

53/80 Hilborough Park FR, 81 Lexham Park on oak PWL 1972, 63/03 Swanton Novers Great Wood on ash PWL, 04 Hull Wood PWL.

Acrocordia salweyi: Uncommon on mortar.

63/02,03 Stody Church PWL 1972, 04 Morston Church PWL and BJC, 31 Witton Church PWL and FR, 33 Happisburgh Church PWL.

Agonimia tristicula: Probably more widespread than the two records suggest.

53/93 Binham Priory on moss on wall PWL and FR 1981, 62/49 Aldeby Church on moss on wall CJBH and PC 1985.

Anaptychia ciliaris: Scarce and decreasing. On the moderately eutrophic bark of ash and elm in parkland and on roadside trees. Early specimens are often luxurious and fertile while most modern material is stunted and infertile. There is a specimen in HbL labelled Norwich 1779. Post 1960 records are as follows:

53/80 Hilborough Park on ash (fertile) FR 1969, still present PWL 1982, 93 PWJ, 94 PWJ, 63/04,12 Heydon Park on ash FR 1971, 22 Westwick Park FR 1969, 62/29 Fritton Common on ash FR 1971, Brooke on roadside tree PWL and FR 1971, both not refound in 1982, 39 Geldeston on elm FR 1971. Pre-1960 records include 53/84,90 63/11,20,31,40 62/19.

Anisomeridium biforme = Anisomeridium nyssaegenum (Ellis & Evans) R. C. Harris: Probably an overlooked species. On eutrophicated bark in shade.

62/18 Shimpling on elder PWL 1977.

+ **Arthonia didyma:** Without material this species should be deleted. A specimen labelled *Arthonia lurida* Wheatfen Broad in HbNWH is *Arthonia spadicea.*

Arthonia impolita: Rather common. On ancient trees in well lit situations such as parklands and open woodland. On elm especially, but also oak, sycamore and lime; probably also on wood on barn doors etc. in the past. Gathered for the first time in Britain by DT "on the trunks of old trees at Bowton near Barton, Norfolk", Eng.Bot. This locality is probably Boughton near Barton Bendish in 53/60 or 70. Recorded from 27 squares, 38.5%

53/62,70-72,84,90,92 52/99 63/00,01,03,04,10-14,(20),22,30,(32),40,42 62/18,19,29,39.

Arthonia lapidicola: Apparently rare. On concrete and glass.

53/63 Between Heacham and Snettisham on concrete posts of old railway line AM 1983. 63/30 Limpenhoe Church on window under a grill CJBH and PC 1985.

+ **Arthonia patellulata:** Without supporting material this species should be deleted. This species is not correctly reported from the Brititsh Isles. A specimen labelled as *Arthonia patellulata* from Wheatfen in HbNWH is *Arthona spadicea.*

Arthonia punctiformis: Uncommon. On smooth bark of hazel, rowan and young oak branches.

53/93 Thursford on hazel PWL 1984, 63/03 Swanton Novers Great Wood PWL and FR 1974, 63/04 Hull Wood on oak PWL 1973, Cley Park Wood on rowan PWL and BJC 1973, 63/14 near Sheringham on oak PWL and FR, (63/20) Thorpe JES 1807, (63/21) Spixworth SAM 1938, (63/51) near Yarmouth DT 1834.

Arthonia radiata: Occasional. On smooth bark of trees in woodlands, parklands and roadside trees. Recorded on hazel, beech and ash. Old records on buckthorn and wood. Recorded from 15 squares (11 post 1960), 15%

53/82,93 52/98,99 63/00-04,(11,12),13,(20,30),42 62/(08,09).

Arthonia spadicea: Locally frequent. Especially on oak and ash in damp shady woodland, perhaps most frequent in Broadland. Recorded from 10 squares, 14.3%

53/84 63/02-04,13-14,21,30,32,40.

+ **Arthonia tumidula:** No recent records and no Norfolk specimens seen.

Arthopyrenia halodytes: Restricted by its habitat requirements. On shells in the intertidal zone, no previous records.

63/04 Blakeney Point PWL and AF 1983, 14 West Runton on barnacles PWL and JGG 1972.

* (**Arthopyrenia punctiformis**): No recent records. On alder, birch and oak.

(53/62) North Wootton C. B. Plowright 1874. Specimens in HbE in *Sphaericei Britannica Cent.* I & II.

Aspicilia calcarea: Frequent. On limestone and occasionally mortar. Especially on horizontal and sloping surfaces. Recorded from 49 squares, 70%

53/40,41,51,52,60,64,71,80-83,90-94 52/69,78-79,88-89,98-99 63/00-02,10-14,20,23,24,30-33,40-42 62/08,09,17-19,28,38,39.

Aspicilia contorta: Occasional. Usually on very hard horizontal limestone. Recorded from 8 squares, 11.4%
53/81,92,94 52/88 63/10 62/09,18,28.

* **Aspicilia gibbosa:** No recent records, but may still occur in the county. On flint.
(63/04) Blakeney Point on bound shingle RCM, (20) Caister St Edmund SAM 1939.

Aspicilia subcircinata: Uncommon. In moderately eutrophic situations on limestone.
63/04 Wiveton on bridge PWL, 22 Buxton Church PWL, 23 Trunch Church on table tomb, 62/09 Great Ellingham Church on buttress PWL 1973 (first record), 28 Redenhall Church on buttress PWL 1981, 39 Ditchingham Church PWL 1981.

Bacidia arnoldiana: Probably overlooked. On elder.
63/04 Cley Park PWL and BJC HbE.

Bacidia bagliettoana: Apparently a rare species cf. *B. sabuletorum* on moss.
52/78 Weeting Heath PWL, (63/04) Blakeney Point on decaying moss and in low shingle WW and FR, 41 BLS mapping scheme.

Bacidia caligans: Probably overlooked. On carstone in garden rockery.
63/01 Lyng PWL 1984.

Bacidia delicata: Previously confused with *Bacidia phacodes.*
62/18 on elder at Shimpling PWL 1977.

Bacidia egenula: Rare or overlooked. On flint in calcareous grassland.
62/39 Hales Green PWL 1975.

Bacidia incompta: Apparently very rare, though possibly overlooked in its sterile form. On elm.
53/62 Sandringham BLS 1968 (first record), 93 Wighton abundant on one hedgerow elm PWL 1975, (62/08) Old Buckenham on hornbeam and oak SAM 1950.

\+ **Bacidia inundata:** Considered very doubtful as it is a freshwater species not marine. Recorded from Blakeney Point by WW and P. W. M. Richards.

Bacidia laurocerasi: Rare or under recorded. On oak in woodland.
63/03 Swanton Novers Great Wood PWL and FR 1974.

Bacidia naegelii: Apparently very rare or overlooked.
63/42 Decoy Wood Winterton on the base of a tree FD 1977.

Bacidia phacodes: Very scarce. On the eutrophic bark of elm and elder. Some of these records may refer to *Bacidia delicata.*
53/93 Near Wighton on elm PWL 1975, 63/03 Gunthorpe Park on elm PWL, Swanton Novers TDVS, (21) Stratton Strawless K&W 1934.

Bacidia rubella: Very scarce on elm in parkland and hedgerows.
53/93 Near Wighton PWL 1975, 63/11 Honingham Park in deep shade on elm PWL, (40) Acle Wood DT HbL, also a specimen dated 1801 from same locality HbL.

Bacidia sabuletorum: Frequent, but probably under recorded. Generally amongst moss on walls. Recorded from 13 squares, 18.5%
53/41,51,94 52/89 63/01,04,13,22,42 62/09,18,39.

Bacidia subfuscula: Rare. On decaying rosettes of sea lavender.
53/84 Scolt Head Island PWJ HbBM.

Baeomyces roseus: Rare. On *Calluna* heath.
53/62 Sandringham BLS 1968, (63/11) Horsford Heath ?KT 1858 HbSAM, (21) Mousehold Heath KT ca 1850.

Baeomyces rufus: Locally abundant. In damp heathland and on banks in heath plantations.
53/62 Foxhills Pentney PWL, 63/01 Bylaugh PWL, 12 Marsham Heath PWL abundant, (11), (21), (22), 33 Bacton Woods PWL.

Bryoria fuscescens: Now very scarce. On bark, wood and on the ground. Early records suggest that it was frequent on fence palings.
53/94 Lodge Marsh Wells in community with *Polytrichum piliferum* and *Usnea articulata* on stabilised shingle covered with sand only a few plants PWL and DSR 1980, 63/03 Swanton Novers village on beech PWL 1972 not present 1978, 04 Blakeney Point on post B&B, abundant on Yankee Ridge on sandy shingle PWL and AF 1983, (12) Salle Rev Bryant HbL ex HbJES, (20) Dunston KT ca 1850 HbNWH.

Buellia aethalea: Probably an overlooked species. On acid stone.
53/84 Holkham Church PWL and BJC, 63/04 Bayfield Park wall PWL and BJC.

Buellia asterella: Extremely rare. On soil in broken turf in calcareous grassland.
52/78 Weeting Heath a few plants in the southern compartment PWL 1972 and 1982. The vc 28 record in Watson's checklist refers to Thetford Heath which is in vc 26, though in the administrative county of Norfolk.

Buellia punctata: Abundant. On trees and occasionally stone in eutrophicated situations. More tolerant of agricultural fertilisers than many species. On a large range of trees. Recorded from 57 squares, 81.4%
53/41,60-64,70-74,80-84,90-94 52/59,68,79,89,98,99 63/00-04,10-14,20-23,30,31,33,40-42 62/08,09,17-19, 27-29,38,39,49.

Buellia stellulata: On stabilised shingle.
53/84 Scolt Head Island B&B, 63/04 Blakeney Point B&B.

Buellia verrucolosa = B. ocellata Flotow: On sandstone.
62/49 Thorpe Church CJBH and PC 1986.

* **Calicium abietinum:** Apparently extinct.
(63/20) Kirby Bedon wood ? KT HbNWH.

Calicium glaucellum: Apparently rare, but possibly overlooked. On wood and bark of decaying stumps of old pollards in replanted woodland.
63/12 Haveringland Great Wood PWL.

* **Calicium quercinum:** Apparently extinct. On wood.
(63/20) Lakenham DT HbBM, (30) Carlton St Peter on wood 1849 HbNWH 'probably this species' BJC, (62/38) Earsham VCH.

Calicium salicinum: Scarce. On the oligotrophic bark of old oaks.
52/99 Merton Park FR, 63/00 Kimberley Park FR, 04 Hull Wood PWL and FR, (10) Bowthorpe on wood KT HbNWH, (20) Framingham VCH, (62/38) Earsham JES.

Calicium viride: Rather frequent. Generally in rather dry situations. On oak and sycamore especially. In woods and parklands. Recorded from 22 squares, 31.4%
53/63,71,72,80,81,90,92 52/89,98,99 63/03,04,10-14,22,(40) 62/08,(09),28,(38).

* **Caloplaca atroflava:** Apparently extinct, though should be searched for.
(63/04) Rat Hill Blakeney Point WW 1920 HbBM.

Caloplaca aurantia: Frequent. On limestone in moderately eutrophic situations. Mostly found on drip courses of church buildings, less often on tombstones. Recorded from 61 squares, 87.1%
53/40,41,50-52,60-64,70-74,80-84,90-94 52/69,70,79,88,89,98,99 63/00-04,10-13,20-24,31-33,40-42 62/08, 09,17-19,27,28,49.

Caloplaca cerina: Scarce. On old ash and sycamore, in pasture and parkland, rarely on wood, now becoming a relict species.
53/64 Hunstanton Park on ancient ash PWL and FR, 72 Houghton Park on sycamore PWL, 92 Guist on ash in pasture PWL 1984, (63/04) Blakeney Point on seablite stems WW, (11) Costessey and Drayton KT, 14 Sheringham Park on ancient ash PWL and FR, (21 or 22) Coltishall DT Eng.Bot., 30 Buckenham on horizontal timbers supporting river bank PWL, (50) Yarmouth DT.

Caloplaca cerinella: Rare, but probably also overlooked. On eutrophicated bark of ash.
63/10 Earlham Park Norwich PWL.

Caloplaca chalybaea: Rare. On limestone or mortar which is moderately eutrophicated.
53/70 Cockley Church on buttress PWL, 52/79 Cranwich Church on table tomb PWL, 63/21 Horsham St Faiths Church on wall PWL.

Caloplaca citrina: Abundant in a variety of habitats. Especially frequent on limestone, mortar and asbestos, but also on trees especially ash, wood, mosses. On soil at Scolt Head Island. Recorded from 64 squares, 91.4%
53/40,41,50-52,60-63,71-74,81-84,90-94 52/68,69,78,79,88,89,98,99 63/00-04,10-14,20-23,30-33,40-42,50, 51 62/09,17-19,27-29,38,39,49.

Caloplaca crenularia: Apparently rare on acid stone in a churchyard and on coastal shingle.
63/04 Blakeney Point HbBM, 62/39 Raveningham Church CJBH and PC 1986.

Caloplaca dalmatica: On hard limestone.
63/42 Sea Palling Church CJBH and PC.

Caloplaca decipiens: Locally frequent. Apparently rare on limestone in churchyards but common in urban habitats on asbestos, cement tiles and concrete. Recorded from 24 squares, 34.2%
53/52,61,62,70,73,81,91 52/68,69 63/01,04,10,12,14,20,21,23,32,41,50 62/08,09,17,19.

Caloplaca flavescens: Abundant. On limestone in moderately eutrophicated habitats, also on brick and cement. Occurs on tombstones in the middle of Norwich. Recorded from 68 squares, 97.1%
Not recorded from 52/59,68.

Caloplaca flavorubescens: Locally frequent in its restricted habitat. On wooden fence posts, bordering salt marshes.
53/84 Burnham Overy PWL 1973, 94 Morston Marshes PWL, 63/04 Blakeney Point PWL 1973.

+ **Caloplaca flavovirescens:** The status of this species is uncertain, most material formerly referred to this species is probably *C. ruderum.*

Caloplaca holocarpa: Frequent. on limestone, mortar and on shells. Also on trees, especially on elm and ash. Recorded from 43 squares, 61.6%
53/50,52,60,63,70-74,81-84,90-94, 52/63,69,78,79,88,89,98,99 63/01-04,11,20,21,31,32,40-42 62/08,09, 17-19,38,49.

Caloplaca lactea: Occasional. On shells on the coast.
53/94 Lodge Marsh Wells PWL 1976, 63/04 Blakeney Point PWL and AF 1984.

Caloplaca luteoalba: Now rare. On elm, rarely on horse chestnut. On parkland and roadside trees. Threatened as elsewhere by the spread of Dutch elm disease.
53/80 Pickenham Hall PWL 1976, (81),(90),(91), 93 Wighton PWL 1975, 63/(11),(13),(23),(30),(31), 62/18 Shimpling PWL, (28), 29 Shotesham Park PWL, Hempnall on horse chestnut PWL 1977, 39 Geldeston FR 1971.

Caloplaca marina: Locally frequent in suitable habitats. On coastal shingle and shells, rarely on wood.
53/84 Scolt Head PWJ and PWL, 94 Lodge Marsh Wells PWL, 63/04 Blakeney Point B&B and PWL.

Caloplaca ruderum: A recently recognised species. Frequent. Mostly on church buildings, especially on the mortar between the flints, but also on limestone. Occasional on tomb stones. Recorded from 39 squares, 55.7%
53/51,63,70-74,80,81,83,84,91-94 52/79,89,99 63/01-04,11,13,14,20-23,30-32,41 62/07-09,17-19,28,38, 39,49.

Caloplaca saxicola: Frequent. On dry limestone and mortar. Mostly on church buildings. Recorded from 56 squares, 80%
53/52,60,62-64,70,71,73,74,80-84,90-94 52/68,78,79,89,98,99 63/00-04,10,11,13,14,20-23,30-33,40-42 62/07,08,17-19,27-29,38,39,49.

* **Caloplaca stillicidorum:** Not found recently though searched for, possibly extinct. Considered by some to be a muscicolous form of *Caloplaca cerina.*
(53/84) Scolt Head Island on decaying rosettes of sea lavender PWJ 1959 HbBM.

Caloplaca teicholyta: Common. On limestone, occasionally cement. Generally sterile but sometimes found fruiting on south facing sloping window ledges and on sloping tombstones. Very fine at Honingham Church 63/01, and Merton Church 52/99. Recorded from 63 squares, 90%
53/40,41,50-52,60,61,63,64,70-74,80-84,90-94 52/69,78,79,88,89,98,99 63/00-04,10-14,20-23,30-33,40-42 62/07-09,17-19,27-29,38,39,49.

Caloplaca ulcerosa: A recently recognised species, apparently rare at least in a fertile form. On hedgerow trees and in small copses.
53/91 Tittleshall on holly PWL 1980, 63/42 Waxham on willow roadside copse PWL 1973, 62/39 Earsham on ash trees in hedgerow PWL 1972 (first record).

Candelariella aurella: Locally common, possibly most frequent in urban areas. On limestone, concrete and cement. Recorded from 23 squares, 32.8%
53/60,71,74,80,91 52/79 63/01,02,04,10-12,14,20,21,24,(30),31,32,41,50 62/18,19.

Candelariella medians: Very common. On eutrophicated limestone, also cement. Occasionally fertile. Resistant to air pollution. Recorded from 60 squares, 85.7%
53/40,41,50,52,60,61,63,64,70-74,80,82-84,90-94 52/69,78,79,99 63/00-04,10-14,20-24,30-33,40-42,50 62/08,09,17-19,27-29,38,39,49.

* **Candelariella reflexa:** No recent records. On ?elm bark
(53/62) Lynn C.B. Plowright 1877-8 Specimen in HbE in *Sphaericei Britannica Cent.* I & II. Associated with *Candelariella xanthostigma,Lecidella elaeochroma, Ramalina fastigiata* and *Xanthoria polycarpa.*

Candelariella vitellina: Abundant in many habitats. Especially characteristic of acid stone, but also often on other substrates eg. brick, tile, slag iron, lignum and leather. The green morph f. *flavovirella* was found at Gayton 53/71 in 1984 PWL and CJBH. Recorded from 69 squares, 98.5%
Not recorded from 52/59.

Candelariella xanthostigma: Uncommon. Generally low down on ancient trees especially ash, elm and sycamore. Recorded from 9 squares, 12.4%
53/62,64 63/03,10,12,13 62/19,29,39.

Catapyrenium lachneum: Very rare. In calcareous Breck grassland.
52/78 Weeting Heath, southern compartment PWL 1972, (62/23) Colby on dry bank. Rev H. Bryant, c. 1805.

Catillaria chalybeia: Apparently rare on acidic stone.
53/60 Stow Bardolph PWL, 74 Holme Church PWL, 63/04 Blakeney Point B&B, 30, 62/19.

Catillaria lenticularis: Possibly an overlooked species. On basic stone.
53/62 BLS meeting, 52/69 Southery Church PWL and CJBH, 63/04 Blakeney Point B&B 62/08.

Fig. 2 *Cetraria islandica* on heather, N. Wootton Common.

+ **Catinaria grossa:** Extinct no specimen seen. Considered doubtful without supporting material.
63/24 Cromer EMH (Bloomfield, 1905).

Cetraria chlorophylla: Occasional. On oligotrophic bark, mostly on the horizontal branches of oak, occasionally on birch, willow and on wood. Recorded from 23 squares, 32.8%
53/61-64,71,72,80,92,93 52/78,89,98,99 63/00,01,03,04,12-14,21,30 62/(09).

Cetraria islandica: (Fig. 2) Very rare. Amongst heather and leaf litter in heathland and birch woodland. Especially abundant in an area of ca 400 square metres under birch. Also reported from heather in the vicinity, but the small colony found by the BLS meeting may have been destroyed in the construction of a golf course. The discovery of a strong colony at North Wootton confirms a mid 19th century record by C. B. Plowright. (A specimen labelled North Wootton 1862 in HbKL may be his). C. P. Petch (pers comm.) remembers finding the plant probably in the same place on North Wootton Common in 1932. The ecology of the site is very similar to the Lincolnshire colony on Lingwood Warren.
53/62 North Wootton Common 1862 HbKL, ? C. B. Plowright, refound 1932 C. P. Petch in heather, one plant AM 1981, abundant under birch NNNS 1983, Ling Common one small patch ca 15cm across amongst heather BLS 1968.

* **Cetraria pinastri:** Extinct. On wooden pales.
(63/20) Framingham DT HbL In Eng.Bot. "Mr. Turner very unexpectedly detected a few small specimens on Mr. Rigby's pales at Framingham near Norwich".

* **Cetraria sepincola:** Extinct. Formerly on wood.
(63/50-51) North of Yarmouth on posts by the sea DT HbL.

Chaenotheca brunneola: Rare. On ancient oaks in oak pasture woodland and parkland.
63/00 Kimberley Park FR, 04 Hull Wood PWL and FR 1973.

* **Chaenotheca chrysocephala:** Extinct. Formerly on wood.
(63/20) Framingham Earl on old wood DT HbBM.

Chaenotheca ferruginea: Common. On oligotrophic bark, usually oak, but also birch, sweet chestnut, willow and pine. Generally fertile. First described by DT from specimens found on pales near Framingham (63/20). Recorded from 34 squares, 48.5%
53/62-64,71,80-84,90-93 52/78,89,98,99 63/01-04,11,13,14,20-22,30,31,42 62/(08,09),18,28.

Chaenotheca hispidula: Rare or overlooked. On dry bark of ancient trees.
63/03 Swanton Novers on oak PWL 1973, 04 Hull Wood on ancient oak PWL and BJC 1973.

Chaenotheca phaeocephala: Extinct. Formerly on wood. The type specimen is from this site (HbBM).
(63/20) Lakenham near Norwich on a barn near Crowes Farm DT HbBM, HbK.

Chaenotheca trichialis: Rare. On ancient oak in oak pasture woodland.
53/93 Thursford Wood PWL 1975.

Chrysothrix candelaris: Rather common. On ash, oak and sycamore in open woodland and parkland. An indicator of the richer bark communities. Recorded from 34 squares, 48.5%
53/62-64,70,71,80,81,84,92-94 52/89,98 63/00-04,11-13,21-24,(30),32,42 62/(08,09),28,38,39.

Cladonia arbuscula: Occasional. Most records are from dunes where it can be locally frequent.
53/62 BLS, 84 Scolt Head Island PWL and AF, 94 Lodge Marsh Wells PWL, 63/04 Blakeney Point B&B and PWL, 42 Winterton area FD, 51 Winterton area MRDS.

Cladonia bacillaris: Apparently rare, on dunes and heathland.
63/04 Blakeney Point B&B, (20) Mousehold Heath SAM 1937 HbNWH, 41 Winterton MRDS.

+**Cladonia caespiticia:** Considered to be a doubtful record in the absence of supporting material as the habitat is not really suitable for this species.
63/04 Blakeney Point B&B.

Cladonia cariosa: Scarce on rather calcareous sand.
53/63 Snettisham on stabilised shingle in broken turf PWL 1983, 91 Hoe in sand pit PWL 1981.

Cladonia cervicornis: Occasional on dunes and acid heathland.
53/62 BLS, 84 Burnham Overy PWL, 52/89 in Stanford Training Area, 63/04 Blakeney Point B&B and PWL. ssp. *verticillata* : 63/12 Cawston Heath frequent amongst heather PWL 1974.

Cladonia chlorophaea: Common. In a variety of habitats including tree stumps, dunes, heathland especially in the early stages following a fire, disused railways and other disturbed ground. An aggregate, the chemical races of which have not been differentiated. Recorded from 28 squares, 40%

53/61,62,64,71,73,74,80,83,84,91,93,94 52/78,89,98 63/01,03,04,10-12,20-23,31,42 62/18.

Cladonia ciliata var. **tenuis:** On heaths and dunes, less common than *C. portentosa* but often mixed with it. Recorded from 7 squares, 10%

53/84,94 52/78 63/04,12,41,42.

Cladonia coccifera: Locally frequent on heaths and dunes especially on a peaty soil. Some records may refer to *C. pleurota*. Recorded from 9 squares, 12.8%

53/62 52/78,88 63/03,12,21,41,42,51.

Cladonia coniocraea: Common on oligotrophic bark and wood, also on peat, cinders and old moss. In woodland, hedgerows, etc. Recorded from 42 squares, 60%

53/62-64,71-73,80,81,84,90,91,93 52/59,78,89,98,99 63/00-04,11-14,20-22,24,30-33,40,42 62/09,18,28,29,49.

Cladonia crispata var. **cetrariiformis:** Locally common. On the more acid heaths and dunes.

53/62 Dersingham and Roydon Common BLS 1968, 53/63 BLS 1968, 63/12 Cawston Heath, 63/21, 63/41 Winterton PWL and MRDS, 63/51 Winterton PWL and MRDS.

Cladonia digitata: Occasional. Usually in damp woodland on oligotrophic bark of oak and willow.

53/62 Sandringham PWL 1974, 52/98 Starston PWL and FR, 63/04 Hull Wood PWL and FR 1972, 63/14 Felbrigg Great Wood FR, 63/41 Near Oby PWL and FR.

Cladonia fimbriata: Common. In a variety of habitats including old walls, gravel workings and tree stumps. Recorded from 32 squares, 45.7%

53/41,51,62,71,80,81,84,91 52/79,89,98,99 63/01-04,10-14,21,22,30-32,41,42,51 62/09,18,39.

Cladonia floerkeana: Frequent on heaths and dunes, on peat and rotting tree stumps.Recorded from 11 squares, 15.7%

53/62,63 63/03,04,11,12,21,22,41,42,51.

Cladonia foliacea: Locally frequent especially on stablised dunes and also grass heaths in Breckland. Recorded from 9 squares, 12.8%

53/62,84,94 52/78,89 63/04,41,42,51.

Cladonia furcata: Frequent on dunes and heaths, generally in rather dry situations, occasionally on rotting tree stumps in these habitats. Recorded from 11 squares, 15.7%

53/62,74,84,94 52/89 63/01,03,04,14,21,42.

C. furcata ssp. **subrangiformis:** Rather uncommon generally in more calcareous parts of heaths.

53/84 Scolt Head Island PWL and EAE, 52/78 Weeting Heath PWL, 63/04 Blakeney Point PWL.

Cladonia glauca: Rare, but locally abundant even dominant on heaths eg. at Cawston and Marsham Heaths.
63/04 Blakeney Point B&B, 12 Cawston and Marsham Heaths PWL, 41, 42 Winterton.

Cladonia gracilis: Uncommon on dunes, heaths and old airfields.
53/94 Lodge Marsh PWL, (63/21) Mousehold HbNWH, 41 Winterton Horsey Dunes PWL, 51 Winterton Dunes PWL, 62/29 Springwood Hardwick on old runway PWL.

Cladonia humilis: Uncommon. On dunes.
53/94 Lodge Marsh Wells PWL 1976, 63/04 Blakeney Point B&B and PWL.

Cladonia macilenta: Locally common on peat in heathlands and on old tree stumps. Recorded from 25 squares, 35.7%
53/61,62,70,72,82,91,93 52/78,79,88,98 63/03,04,11-14,(21),22,30,31,41,51 62/18,28.

Cladonia ochrochlora: Uncommon on tree stumps in woodland.
52/89 Starston Carr PWL and FR 1972, 63/12 Great Wood Buxton Heath PWL 1970.

Cladonia parasitica: Rare on heath banks, and tree stumps.
53/62 BLS, 90, 52/99 Merton Park FR, (63/03) Holt Wood WJH Eng.Bot., 04 Hull Wood FR, 21 Horsford FR.

Cladonia pleurota: Status uncertain. On heathland. All specimens det. SAM.
63/12 Buxton Heath PWL 1970, (42) Winterton Dunes C. Hasnip 1966.

Cladonia pocillum: Occasional. In chalk grassland in Breckland, on calcareous dunes and on wall tops.
53/61, 71, 84 Burnham Overy Dunes PWL, 90, 52/78 Weeting Heath PWL, 89 Stanford Training area PWL.

Cladonia polydactyla: Uncommon on woodland banks and bases of trees.
53/62 BLS, 63/03 Swanton Novers PWL and FR, 21 Horsford PWL and FR.

Cladonia portentosa: Locally abundant on dunes, eg. Lodge Marsh also inland on heaths. Recorded from 11 squares, 15.7%
53/62,63,84,94 63/01,04,11,12,22,41,51.

Cladonia pyxidata: Rare or overlooked on dunes.
53/04 Blakeney Point PWL and AF 1983, 42 Winterton MRDS.

Cladonia ramulosa: Locally abundant on dunes, occasional on heaths inland.
53/62 BLS, 53/84 Burnham Overy dunes PWL 1973, 53/94 Lodge Marsh Wells PWL, 63/04 Blakeney Point B&B, PWL 1970, 63/12 Cawston Heath PWL 1978, 42 Winterton.

Cladonia rangiformis: Rather common in chalk grassland in Breckland also on the less acid dune systems. Occasional in sand pits. Recorded from 8 squares, 11.4%
53/64,84,91,94 52/78,89 63/04,11.

Cladonia scabriuscula: Rare on dunes, and rather disturbed sites.
53/94, 63/01 Sparham in old gravel pit, 32 Fox Hills Northrepps on old tennis court.

Cladonia squamosa: Occasional on acid heaths and dunes. Recorded from 7 squares, 10%
53/61,62,63,84 63/04,12,21.

+ **Cladonia stellaris:** Recorded from Scolt Head Island by Dickinson and from Blakeney Point by RCM as *C. alpestris*. Almost certainly an error for *C. portentosa*.

Cladonia strepsilis: Very rare. On damp peat associated with cross-leaved heath and bell-heather.
63/22 Bryants Heath FR 1970.

Cladonia subulata: Uncommon. On dunes and in an inland sand pit.
53/84, 91 Hoe PWL 1981, 63/04 Blakeney Point B&B.

Cladonia sulphurina: Very rare. One small colony amongst heather on a heath. A northern species rare in the south of the British Isles.
63/12 Marsham Heath PWL 1972.

Cladonia uncialis ssp. **biuncialis:** Locally frequent. On heaths and dunes generally preferring the damper situations. eg. at Cawston where it is luxuriant in old trenches. Recorded from 7 squares, 10%
53/62,63,84 52/98 63/12,22,42.

Cliostomum graniforme = Cliostomum corrugatum (Ach.) Fr.: Very rare. On wooden fence posts, and formerly on barn doors. Also recorded on shrubby seablite. An Eastern species in Britain which has apparently declined since the last century. "Mr. D. Turner first observed this species on a wooden barn of Mr. Crowe's at Lakenham, where we have often examined it and found it the same" Eng.Bot.
53/84 Scolt Head on shrubby seablite PWJ, Burnham Overy on fence post on edge of salt marsh PWL 1975, (63/20) Lakenham DT HbBM, (21 or 31) Coltishall DT HbBM, (41) Acle on barn door DT HbBM, (50) Great Yarmouth HbBM.

Cliostomum griffithii: Common. On dry bark on trees in parkland, woods and hedgerows. Recorded on oak, ash, sycamore, elm, willow, also on apple, elder and marram. Generally sterile but sometimes found fruiting. Recorded from 41 squares, 58.5%
53/62,63,70-73,81,82,91-94 52/59,78,89,99 63/00-04,10-14,22,23,30-33,41,42,51 62/09,17-19,28,29.

Coelocaulon aculeatum: Locally abundant. On heaths and dunes. Found fruiting at Cawston Heath. Recorded from 17 squares, 24.2%
53/62,72-74,84,94 52/89,98 63/01,04,(11),12,22,41,42,(50),51 62/(09).

Coelocaulon muricatum: Apparently rare, but possibly more common than recorded due to confusion with the previous taxon. On heaths and dunes.
63/04 Blakeney Point PWL and AF 1984, 12 Cawston Heath PWJ and PWL.

Fig. 3 *Cyphelium iniquinans* on wood, Shimpling Church.

Collema auriforme: Uncommon. On mortar or limestone in churchyards and ruins. Recorded from 8 squares, 11.4%

53/71 Gayton Church PWL and CJH, 81 Castle Acre Priory PWL, 83, 93 Binham Priory PWL and FR, 63/02 Thelmingthorpe PWL, 20 Caister PWL, 42 FD, 62/18 Frenze Church PWL.

Collema crispum: Frequent. On limestone and mortar in churchyards and on old ruins, preferring damp situations. Recorded from 14 squares, 20%

53/70,72,92-94 63/01,02,04,20,23 62/17,18,28,29.

* **Collema cristatum:** Not seen recently but may still occur.

(62/09) Old Buckenham on the ground in closely mown grass of cricket field SAM 1951 HbSAM.

* **Collema limosum:** Not seen recently, but the habitat has not been well studied in the present survey, may be refound.

(63/14) West Runton on wet sandy cliff face SAM 1948 HbSAM.

\+ **Collema nigrescens:** Described as common by CJP&JP in the Yarmouth area, but considered doubtful as no Norfolk specimens have been traced.

Collema tenax: Occasional. On calcareous soil in old pits, chalk grassland, wall tops etc. Recorded from 10 squares (7 post 1960), 14.2%

53/63,82 52/89,98 63/10,14,(20) 62/(08,09),39.

* **Coniocybe furfuracea:** Extinct, specimen not seen.
(53/62) North Wootton VCH.

Coniocybe sulphurea: Rare. On elder in shady situations.
63/04 Hull Wood PWL 1977, 62/18 Shimpling PWL 1977.

Coriscium viride: Apparently very rare on heaths. 63/24 Sheringham SAM 1965.

Cyphelium iniquinans: (Fig. 3) Locally frequent. On wooden gates and posts and occasionally on oak. Its absence from some parts eg. West Norfolk is probably due to the scarcity of suitable habitats and intensive farming. Recorded from 30 squares (27 post 1960), 42.8%
53/74,81,84,91,94 52/98,99 63/01-04,10,11,13,14,20,(21),22,(30),31,40-42,(50) 62/08,09,18,27-29.

Cyphelium notarisii: Frequent in a very limited area. On wooden gates close to the sea in pasture or nature reserves. An eastern species.
53/84 Burnham Overy dunes T. Ottley and PWL, 63/04 Cley on four gates around the Norfolk Naturalists Trust Reserve, Glandford on one gate ca 4 km from the sea, (50) Yarmouth DT.

(**Cyphelium sessile**): Rare. On the lichen *Pertusaria* in parkland.
53/91 Mileham PWL and FR 1989, 63/12 Heydon Park FR.

+ **Cyphelium tigillare:** This should be deleted from the Norfolk list. There is sterile material which maybe this species in HbBM from Yarmouth South Town which is in vc 25.

Dimerella diluta = **Dimerella pineti** (Schrader) Vezda: Occasional. In damp shady woods, especially in some of the older Broadland carrs. On oak, ash and willow. Recorded from 15 squares, 21.4%
53/93 52/78,79,99 63/02-04,11,13,14,30-32,40 62/18.

Diploica canescens: Abundant. On eutrophicated bark of elm, ash, and sycamore especially, also on stone and one of the few lichens to grow on ironstone. Occasionally fertile as at Saxlingham (on elm), Yelverton, Waxham and Shimpling (on stone). Perhaps more tolerant of artificial fertilisers than other species. Recorded from all squares, 100%

Diploschistes muscorum: Rare. On the lichen *Cladonia pocillum* on grass heath and dunes.
53/84 Burnham Overy dunes PWL, 52/78 Weeting Heath in southern compartment PWL, (53/62) Kings Lynn on carrstone ELS 1958, (63/11) Horsford SAM 1940, (14) Beeston Regis Hall SAM 1948, (30) Wheatfen Broad SAM 1940, (62/09) Old Buckenham SAM1949. This is probably the species referred to by Smith in Eng.Bot. "as in lawn at Ashill (53/80) of Rev. Watt, the turf coming from a warren" 1799.

Diploschistes scruposus: Frequent. On old brickwork and on carstone in churchyards, park walls etc. Recorded from 31 squares (30 post 1960), 44.2%
53/51,61-64,71,73,81,83,90,91 52/69,88,89 63/01,02,04,(10),11-13,22,23,33,41,42 62/08,18,19,29,39,49.

Diplotomma alboatrum: Very common. On limestone mortar and plaster, also occasionally on clay lump buildings. Not seen on bark recently. Recorded from 61 squares, 87.1%

53/40,51,52,60-64,70-74,80-84,90-94 52/69,78,79,88,89,99 63/00-04,11-14,21-24,30-33,40-42,51 62/07-09,17-19,27-29,38,39,49.

Dirinia massiliensis f. **sorediata:** Abundant. Mainly on the north walls of churches; on limestone, plaster and mortar. Recorded from 61 squares, 87.1%

53/40,51,52,60-64,70,72-74,80-84,90-94 52/69,78,79,89,98,99 63/00-04,11-14,21-24,30-33,40-42,51 62/07-09,17-19,27-29,38,39,49.

* **Endocarpon adscendens:** No recent records.

(52/88) Thetford on mud walls DT HbBM, (63/21) Mousehold Heath KT.

Enterographa crassa: Fairly frequent on ash, oak, beech and elm in damp shady woodland. Probably not an ancient woodland indicator in Norfolk as it occurs in some Broadland carrs. Recorded from 22 squares, 31.4%

53/62,71,84,93 52/98,99 63/00,01,03,04,11-14,20-22,24,30,33,40 62/18.

Enterographa sorediata: Very rare. On ancient oak in damp sheltered valley.

63/24 Northrepps Cottage Wood PWL 1974, first collection of this new species, sterile at this site. Elsewhere this species is known only from the New Forest.

Evernia prunastri: Very common. On a variety of trees including oak, ash, willow, beech, lime, poplar, and sycamore. Occasionally on dunes, and old gravel workings, Found fruiting at Geldeston (62/39) in ca 1805 OBG and on Dunston Park pales (63/20) KT 1849. Recorded from 63 squares, 92.8%

53/51,60,64,70-74,80-84,90-94, 52/59,68,78,79,88,89,98,99, 63/00-04,10-14,20-24,30-33,40-42,50,51 62/08,09,17-19,27-29,38,39,49.

Foraminella ambigua: Uncommon, though occasionally locally abundant. Largely confined to tree stumps, though at Shadwell 52/98 it was abundant on a fallen ash and at Ling Heath and North Wootton Common (53/62), it is abundant on birch. Recorded from 7 squares, 10%

53/62 52/89 63/11,12,14,20,21.

Fuscidea lightfootii: Apparently rare on bark.

53/62 BLS 1968, 63/03, (21) Stratton Strawless Heath on smooth bark Borrer HbBM.

Graphis elegans: Generally uncommon but locally abundant as at Swanton Novers Great Wood in the sessile oak coppice and at Felbrigg on beech. On smooth bark of young oak, beech, holly and rowan, mostly in woods. Recorded from 9 squares, 12.8%

53/62,71,93 63/03,11-14,21.

Graphis scripta: Rarer than the previous species and never locally abundant. Mostly on beech, holly and hazel.

53/93 Thursford on hazel PWL, 52/98 Shadwell Park on beech PWL, 99 Merton Park FR, 63/03 Swanton Novers FR, (63/22) Ringland on beech SAM 1949, (22) Coltishall VCH, (62/08) Old Buckenham on hornbeam SAM 1950

* **Gyalecta geoica:** Apparently extinct
(63/24) Cromer on old wall associated with *Caloplaca flavescens* and *Diploica canescens* 1879 HbBM.

* **Gyalecta jenensis:** Apparently extinct, though it has been recently found at Ancaster in Lincolnshire and might possibly be refound.
(63/12) Corpusty Church "found on stone walls in Norfolk in a northern exposure; as on Corpusty Church, by the Rev. Mr. Bryant and Mr D. Turner." Eng.Bot. Date given as 1800 in Bloomfield (1905).

Gyalecta truncigena: Very rare. On elm in hedgerow.
53/93 Wighton at Field Barn PWL 1975.

Gyalideopsis anastomosans: Apparently uncommon. On oak, holly and elder in shady woodland. Only found sterile.
63/04 Hull Wood on oak PWL and BJC 1973, 13 Ponds Hills on holly and elder PWL and BJC 1973.

Haematomma elatinum: Very rare. On oak in woodland.
63/02 Foxley Wood FR 1969.

Haematomma ochroleucum: Common in a variety of habitats. Var. *ochroleucum* is the common species on trees on sycamore, lime and elm. Var. *porphyrium* is the common form on stone and occasionally dominates the north walls of churches eg. at Sparham. Always sterile. Recorded from 43 squares, 61.4%
53/51,60-64,70-73,80,82,84,90-93 52/68,69,89,98,99 63/00-04,10-14,22,23,30,32,41 62/08,18,19,29,38,39, 49.
H. ochroleucum var.*ochroleucum* 63/02, 12; var. *porphyrium* 53/60,64,73 63/11 62/18.

Huilia tuberculosa = Porpidia tuberculosa (Sm.) Hertel & Knoph: Common. On acid stonework, probably one of the most constant species in this habitat. Recorded from 52 squares, 74.3%
53/40,41,51,52,60,63,64,71-73,80-84,90-94 52/69,78,88,99 63/01-04,11-14,20,22-24,30-33,40,41,51 62/09,17-19,27,28,38,39,49.

Hyperphyscia adglutinata: Rare. On ash in parkland and on commons.
53/90 Letton Hall Park, FR 1970 62/29, Fritton Common FR 1971.

Hypocenomyce caradocensis: Rare. On oligotrophic bark in heathy woodland. It may be more common than the records suggest as it could be easily overlooked in the sterile state.
53/62 Sandringham BLS meeting 1968, 63/21 Horsford on oak PWL and BJC 1973.

Hypocenomyce scalaris: Fairly frequent. On the oligotrophic bark of oak, juniper, lime and pine. Also not infrequent on carstone and rarely brickwork. Tolerant of pollution eg. on lime near the centre of Norwich. Recorded from 30 squares, 42.8%
53/61,63,71-73,80,81,92,94 52/69,89,98 63/00,02-04,11-14,20,21,24,30,41,42 62/18,29,49.

Hypogymnia physodes: Generally abundant, though locally rare in parts of north west Norfolk and the Fens. On the oligotrophic bark of oak, pine, willow, beech, juniper, ash, birch, lime and heather. Also on wood and sometimes on the ground

on heaths, dunes and old gravel workings. Occasionally on acid stonework. Formerly fertile as at Spixworth (63/21) KT 1849 HbNWH. Recorded from 57 squares, 81.4%
53/52,60-64,70-72,74,80-84,90-94, 52/78,79,88,89,98,99, 63/00-04,10-14,20-24,30-33,40-42,51 62/08,09,18,19,28,29.

Hypogymnia tubulosa: Occasional. On oligotrophic bark of oak and on heather. Also on acid tombstones and wood. Recorded from 21 squares, 30%
53/61,64,70,71,81,83,84,93 52/98 63/00,01,04,11,12,21,30,32,33,42 62/09,19.

Lecanactis abietina: Very locally frequent. On the dry bark of oak and beech, mostly in woodland. Sometimes fertile as at Swanton Novers on beech and Pond Hills on oak. Recorded from 7 squares, 14.2%
53/93 63/03,04,12-14,28.

Lecanactis hemisphaerica: Very rare. On limestone on the west-facing walls of two churches, growing under a drip course in both instances. A very xeric habitat. An extremely eastern species in Britain, searched for but not found in north Norfolk.
63/41 Runham Church PWL 1980, Filby Church PWL 1981.

Lecanactis premnea: A rare species of ancient oaks, in parkland and in old oak pasture woods.
53/62 Sandringham BLS 1968, 90 Letton Hall Park FR, 93 near Gunthorpe Park PWL, 52/99 Merton Park FR, 63/04 Hull Wood PWL and FR, 13 Felbrigg in park FR, 31 Woodbastwick Hall PWL 1971.

Lecania baeomma: Apparently very rare. On brick of churchyard wall.
53/91 Hoe Church PWL 1979.

Lecania cyrtella: Status uncertain, possibly an overlooked species. On trees.
63/00 Kimberley Park FR, (50) near Yarmouth DT 1810, (62/09) Old Buckenham on elder SAM 1949.

Lecania erysibe: Fairly frequent. Now considered to be an aggregate. On limestone and mortar. Recorded from 17 squares, 24.2%
53/52,60,61,63,71,84,94 63/04,13,14,31,33,42 62/08,17,39.
f. *soredifera* 53/92, 52/59 Blackdyke Farm, 69 Southery Church.

Lecania nylanderiana: Rare. There is some doubt about the correct identity of this taxon. On plaster and mortar on vertical church walls.
53/91 Bittering Church PWL 1982, 62/07 Blo Norton Church PWL 1981.

Lecanora albescens: An overlooked species now believed to be widespread and frequent. On limestone, mortar and sometimes brick. Recorded from 7 squares (all in 1984), 10%
53/64,94 52/68,69,89 63/01,02.

Lecanora atra = Tephromela atra (Huds.) Hafellner: Common. On brick, sandstone, flint and other acid stone substrates. Occasional on flint pebbles above HWM. In consolidated shingle as at Blakeney, Lodge Marsh, Wells and Scolt Head Island. On a wooden gate at Fincham PWL. Recorded from 61 squares, 87.1%
Not recorded from 53/50,52,73 52/59,68 63/00,10,50 62/07.

Lecanora campestris: Common. On stonework in churchyards and elsewhere. On cement, limestone, asbestos and also calcareous sandstone. Recorded from 68 squares, 97.1%

Not recorded from 52/59 63/40.

Lecanora carpinea: Occasional. The frequency of pre 1960 records suggests that it might be a declining species. On the smooth bark of ash and walnut, usually on hedgerow and parkland trees, also on the edge of woods. Formerly on hornbeam, and elder.

53/60 near Fincham PWL, 53/62, 70 near Beechamwell PWL, 94 Wells on fence, 52/89 Starston carr PWL and FR, (63/10) Bawburgh HbSAM, (11) Felthorpe SAM 1937, Drayton 1937, Horsford 1940, 13, (20) Norwich Tuckswood FM 1852, Arminghall SAM 1942, (21) Stratton Strawless KT, (30) Rockland on buckthorn, (62/08) Old Buckenham, 28 Bath Hills Ditchingham PWL 62/39.

Lecanora chlarotera: Common. On smooth bark especially of ash and walnut, but also on beech, poplar, oak and sycamore on hedgerow trees and in woodland. On wood in coastal situations. Recorded from 36 squares, 51.4%

53/60,62,64,70-72,74,81,84,90,92,93 52/89,98,99 63/01-04,10,12-14,20,22,23,30,31,42, 62/08,09,18,19,28,29,39.

Lecanora conizaeoides: Abundant. On acid stone, brick etc., also on most tree and shrub species, other substrates include iron, rubber, canvas, leather etc. Quite commonly fertile. The first records appear to have been on pine and birch in 1936.

63/11 Drayton Brecks on pine SAM 1936, Hellesdon on pine SAM 1936, 30 Surlingham Wood on birch SAM 1936. Recorded from all 70 squares, 100%.

Lecanora crenulata: Frequent. On limestone, especially the hard oolitic limestones used as corner stones on churches. Recorded from 54 squares, 77.1%

53/41,50,52,60,63,64,71-73,80-84,90-94 52/69,78,79,89,98 63/00-04,10-13,20-23,30-33,40-42 62/07-09,17-19,27-29,49.

Lecanora dispersa: Abundant. Probably an aggregate of several closely related taxa. On limestone, cement, asbestos, brick. Also on eutrophicated bark and wood. Var. *zosterae* is frequent on plant remains eg. on sea lavender tussocks at Scolt Head Island and Blakeney Point, also probably elsewhere on the coast. Recorded from all grid squares, 100%.

Lecanora expallens: Common. On the smooth bark of oak, ash, sycamore and beech also on walnut and elm. On wood near the coast. Rarely fertile. Recorded from 49 squares, 70%

53/60,62,64,71,72,74,80-82,84,90-94 52/68,79,89,98,99 63/00-04,10-14,21-24,30-33,40-42,51 62/09,18,19,28,29,38,39,49.

+ Lecanora intumescens: A western species in southern Britain which from its known distribution is unlikely to occur in Norfolk. Should be deleted from the list.

Recorded from (63/21) Plumstead and Sprowston K&W 1934.

Lecanora muralis: (Fig. 4) Common. On acid horizontal stonework and tiles in moderately eutrophic situations. Occasional on limestone, concrete and mortar in urban areas. Also on flint pebbles in stablised shingle bordering salt marsh as at

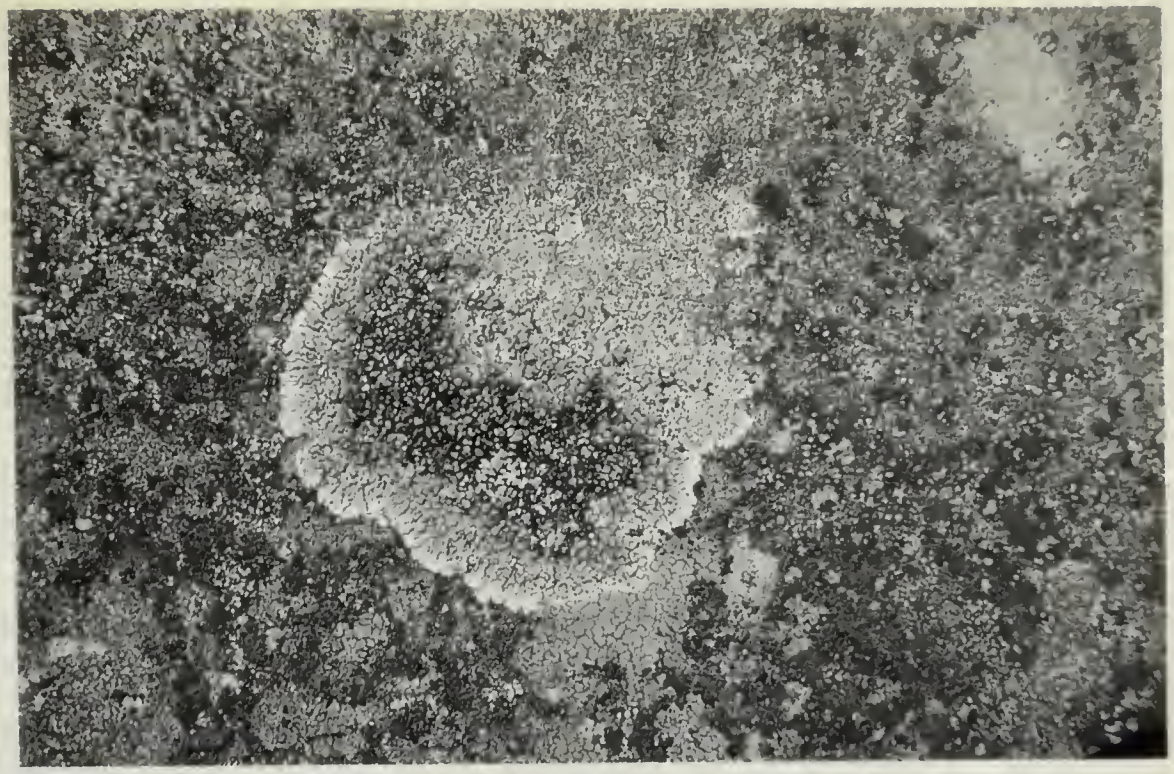


Fig. 4 *Lecanora muralis* on stone.

Blakeney Point and on a sandstone pebble at Weeting Heath. Sometimes on wood especially on planks across dykes and rarely on trees in dusty eutrophic situations as at Hellesdon. Recorded from 66 squares, 94.2%
Not recorded from 52/59 63/24,51 62/38.

Lecanora pallida: Very rare now, possibly less so formerly. On trees.
63/23 Templewood on one tree in an avenue of trees PWL 1977, Pre 1960 records include : (53/62) N. Wootton EMH, (52/99) Saham Toney E.R.Noble 1939, (63/03) Holt EMH, (12) Stratton Strawless KT, (30) Wheatfen, (62/09) Old Buckenham on elder SAM 1949.

Lecanora polytropa: Widespread, but rarely abundant. On acid stone especially on table tombs and coping stones on bridges. Recorded from 24 squares, 34.2%
53/40,41,52,64,71,81,83,84,94 52/69 63/01-04,10,20,32,33,40 62/07,08,19,28,49.

* **Lecanora populicola:** Extinct.
(63/21 or 22) Coltishall on poplar DT HbBM ex Kew. First and only British record, Laundon (1970).

Lecanora pulicaris: Rare. On smooth oligotrophic bark in woodland.
63/02 Foxley Wood PWL 1970, 04 Hull Wood PWL 1973, 21 Horsford PWL and BJC, (30) Wheatfen EAE 1937, 32 Sutton Broad PWL.

Lecanora soralifera: Occasional. On acid stone and sometimes on brickwork. Recorded from 9 squares, 12.8%
53/64,71,74,92,94 63/01,02,30 62/28.

Lecanora symmicta: Apparently rare on drift wood.
63/04 Blakeney Point B&B.

Lecanora varia: Apparently rare or very rare on wood.
63/04 Blakeney Point PWL and AF 1984, (11) Costessey KT, 42 Winterton MRDS.

Lecidea fuscoatra: Occasional. On acid brick and stone of tombs and walls.
53/62, 72, 84, 91, 63/01 Lyng.

Lecidea monticola = Clauzadea monticola (Ach.) Hafellner & Bellem.: Apparently rare on limestone.
63/20 Dunston on limestone tombstone PWL 1973.

Lecidea orosthea: Apparently very rare but possibly overlooked. On brick.
53/91 Hoe on a brickwall PWL 1979.

Lecidea sulphurea: Frequent on old brickwork and acid stone especially near the coast often on wall tops in moderately eutrophic situations. Recorded from 44 squares, 62.8%
53/40,41,51,60,63,72,74,82,83,84,91,92,94 52/69,79,89,98 63/01-04,11-14,20,22-24,30-33,41,42,51 62/08,09,17,18,27,28,38,49.

Lecidella elaeochroma: Occasional. In woodland, sometimes parkland mainly on ash and oak. f. *soralifera* has been found at Merton Park 52/99 in woodland PWL Recorded from 16 squares, 22.8%
53/64,71,92,93 52/89,99 63/02,04,10,13,14,42 62/19,28,29,39.

Lecidella scabra: Occasional. On acid stonework and brick in churchyards. Recorded from 17 squares, 24.2%
53/63,90,91,94 63/04,11-14,23,30,31,33,40 62/17,19,39.

Lecidella stigmatea: Common. Especially on horizontal limestones, cement, also on asbestos. Recorded from 35 squares, 50%
53/40,41,51,52,60-64,73-74,82,83,91 52/69,78,88,99 63/02,10,11,12,20,22,30,31,32,42,51 62/08,17,18,19,39,49.

+ Lepraria crassissima: A doubtful record without supporting material.
53/62 Sandringham Church BLS 1968.

Lepraria incana: Abundant. On soil, bark, wood and stone usually in shaded sheltered situations always sterile. Recorded from 68 squares, 97.1%
Not recorded from 52/59 63/51.

= Leproloma vouauxii (Hue): A newly recognised species so far only confirmed from one site. However, previous records of a taxon tentatively referred to *Lepraria membranacea* probably belong here. It is likely that this species will prove to be common in shaded situations on stonework and on mosses.
(52/78) Weeting 1960 F. Brightman det J .R. Laundon.

Leproplaca chrysodeta: Occasional. On mortar in rather shady vertical situations. Recorded from 12 squares, 17.1%
53/61,64,71,74,83,91,94 52/89 63/02,13,14 62/29.

* **Leptogium gelatinosum:** Extinct. On old walls.
(63/20) Thorpe Norwich DT ca 1805, Bishopsthorpe Norwich KT.

Leptogium lichenoides: Uncommon. Saxicolous on carstone wall tops and mossy walls.
53/63 Ringstead area on carstone walls AM 1983, 73 Ringstead area on carstone walls AM 1983, 74 Ringstead area on carstone walls AM 1983,(63/14) Cromer on old mossy walls Larbaliester HbBM.

* **Leptogium palmatum:** Probably extinct. On dunes.
(63/50) Yarmouth Denes DT HbBM, (51) Hemsby DT In Eng.Bot. "Mr. Turner favoured us with specimens in frutifications from sandy ground to the north of Yarmouth near the sea."

Leptogium schraderi: Rare. On limestone.
(63/51) Caistor Church DT Eng.Bot., '62/28) Pulham St Margaret crevices of table tomb PWL 1975.

* **Leptogium tenuissimum:** Probably extinct. In Eng.Bot. as *Lichen subtilis* "our specimens were sent from Coltishall, Norfolk by Mr. Turner."
(63/11 or 20) Coltishall DT, (20) Norwich on a sandy bank JC 1782, (50) Yarmouth DT, (62/29) Harleston DT, (39) Ditchingham OBG.

Leptogium turgidum: Rare. On limestone.
62/29 Pulham St Mary Church on table tomb PWL 1977.

Melaspilea ochrothalamia: Rare. On oak in woodland.
63/04 Hull Wood PWL and BJC 1973.

Micarea denigrata: Probably an overlooked species. On wood.
63/04 Blakeney Point on old timber PWJ 1962 and B&B 1962, 21 Horsford on an old gate PWL and BJC 1973.

Micarea melaena: Probably an overlooked species. On shrubs.
63/12 Marsham Heath on gorse and heather PWL and BJC 1973.

Micarea nitschkeana: Probably an overlooked species. On gorse and heather
53/91 Hoe Common PWL, 63/12 Marsham Heath PWL and BJC 1973.

* **Micarea peliocarpa:** No recent records
(63/21) Horsford Heath KT 18 HbNWH.

Micarea prasina: Probably an overlooked species. On oligotrophic bark in shady situations.
63/03 Swanton Novers PWL, 04 Hull Wood PWL and FR, 14 Felbrigg Great Wood FR, 32 Barton Turf PWL.

* **Moelleropsis nebulosa:** Extinct. Formerly on banks and dunes.
(53/62) North Wootton on dry shady banks Larbaliester HbBM, (63/02) Guestwick E. Skepper, (11) Felthorpe ?KT 1856 HbSAM, (11) near Great Yarmouth on turfy ground and Hemsby CJP&JP ca 1834.

Mycoblastus sterilis: Probably an overlooked species. On bark.
63/03 Swanton Novers Great Wood.

* (**Mycocalcium subtile**): Extinct. Formerly on wood.
(63/50) Great Yarmouth. Described by DT in Lich. Brit. as on old timber, frequently under the eaves of thatched buildings.

Mycoporum quercus: Occasional. On the smooth bark of twigs of oak.
53/62 BLS, 71 BLS, 63/04 Hull Wood PWL and FR, 13 Pond Hills PWL and BJC 1973, 14 Sheringham PWL and FR 1972, 21 Horsford PWL and BJC 1972.

Ochrolechia androgyna: Rare. On oligotrophic bark of oak.
53/61 BLS 1968, 62 Sandringham BLS 1968, 63/04 Hull Wood PWL and FR, 12 Blickling Park FR.

\+ **Ochrolechia frigida:** This should be deleted from the Norfolk flora as this arctic alpine species is very unlikely to have occurred in the county in historic times. However the identity of the lichen '*Lichen upsaliensis*' recorded both by Bryant from sandy heaths north of Norwich in about 1782, by DT from near Sprowston and by Bryant from Cawston Heath 1782 is uncertain.

Ochrolechia parella: Locally frequent. On acid stone and brickwork especially on wall copings. Most frequent near the sea particularly in north east Norfolk. Recorded from 13 squares (12 post 1960), 18.5%
53/84 52/98 63/02,03,13,14,(20),24,30,33,41 62/18,19.

Ochrolechia subviridis: Moderately frequent. On ash, sycamore, and walnut in moderately eutrophic situations in parklands and old pastures. Recorded from 33 squares, 47.1%
53/60,62,64,72,80,82,90,93 52/68,89,98,99 63/00-04,10-14,22,23,30,41 62/08,09,18,28,29,39,49.

Ochrolechia turneri: Uncommon. On ash, elm, walnut and sycamore in parklands and old pasture.
52/89 Stanford Training Area, 53/92 Sennowe Park 63/02, 12 Heydon Park PWL, 21, 42.

Opegrapha atra: Occasional. On smooth bark of ash, sycamore and walnut. Mostly in parkland or trees in pasture. Recorded from 24 squares (20 post 1960), 34.2%
53/60,71,80,82,84,92-94 52/68,99 63/00,02-04,(11,12),13,14,(21),22,42 62/(09),19,29.

Opegrapha chevallieri: Considered now by Coppins and Pentecost to be a conspecific with *O. saxatilis*. Locally frequent. On mortar and limestone on the north walls of churches within about 30 km of the coast, less so further inland, apparently more abundant in East Norfolk than in West. Occasional on tombstones. Recorded in about 1850 from Wreningham church (62/19) by KT, still present 1974. Recorded from 30 squares, 42.8%
53/51,62,64,91,94 63/01-04,(10),11-14,20,22,23,31-33,40-42 62/19,28,29,38,49.

Opegrapha corticola: Rare. On old oak in oak pasture woodland.
63/04 Hull Wood PWL and BJC 1973.

Opegrapha herbarum: Occasional. Mostly on ash and elm, occasionally on other species eg. apple. In woods, parks and on hedgerow trees usually in well-lit situations. Recorded from 10 squares, 14.2%
52/59,79,89 63/02-04,24,40 62/18,28.

Opegrapha lyncea: Restricted to ancient oaks in parkland and in oak pasture woods. At Gawdy Hall Wood occurs on an ancient standard in coppice-with-standards woodland. In OBG Trees in Lord Woodhouse's Park at Kimberley, Rev. Alderson, still present in 1980. Recorded from 11 squares, 15.7%
53/62,71,90-93 52/99 63/00,04,11,24 62/28.

Opegrapha niveoatra: Rare. On ash in oak pasture woodland.
63/04 Hull Wood PWL and BJC 1973.

Opegrapha ochrocheila: Uncommon. Usually in damp shady situations on ash, elm and willow.
52/89 Starston Carr PWL and FR, 63/03 Swanton Novers Great Wood PWL, 11 Honingham PWL, 30 Wheatfen PWL, 62/(09) Old Buckenham SAM 1949, 18 Shimpling PWL.

Opegrapha rufescens: Rare. On ash in oak pasture woodland.
63/04 Hull Wood PWL and BJC 1973.

Opegrapha saxatalis: Previously considered rare but now considered to be conspecific with *O. chevalleri.*
63/12 Corpusty Church on wall PWL, (62/09) Old Buckenham Hall SAM 1950.

Opegrapha sorediifera: Rare, but probably also overlooked because of its resemblance to *Trentepohlia* algae. On oak and elm.
63/03 Cley Park Wood on oak PWL and BJC 1973, 62/29 Tyrells Wood PWL.

Opegrapha varia: Occasional. On hedgerow trees also in parkland and sometimes woods. Mostly on elm. Recorded from 11 squares, 15.7%
53/62,64,70,73,80,92 52/89 63/13,40 62/49.

Opegrapha vermicellifera: Occasional. On elm and rarely on elder in damp woodland and sheltered hedgerows. Recorded from 8 squares, 11.4%
53/81 52/68 63/02,04,11,22 62/18,29.

Opegrapha vulgata: Fairly frequent. Especially on elm in hedgerows, less often in woods. Recorded from 7 squares, 10%
53/60,90 52/89 63/04,14,42 62/18.

+ **Pannaria leucophaea:** Extinct. Recorded as *Lichen escharoides* in Eng.Bot. "This new addition to our list of British Lichens was discovered by Mr. Turner in his tour of Cornwall in 1799 and near Yarmouth in June last." Without supporting material this is considered doubtful.

⋆ **Pannaria pezizoides:** Extinct. Formerly on sandy heaths and dunes.
(53/62) North Wootton on dry shady banks Larbaliester, (63/02) Guestwick E. Skepper, (51) Hemsby and Yarmouth.

Parmelia acetabulum: Widespread but rarely abundant. On sycamore, ash, walnut, oak, lime and elm. Fertile in the Stanford Training Area and abundantly so on a walnut at Gunthorpe Park. Mostly now in parkland but occasionally still found on hedgerow trees. First found in Britain by James Smith on Mr. Crowe's land at Saham Park near Sporle in 1799. Recorded from 29 squares, 41.4%
53/60,71,80-82,84,90,93,94 52/59,68,78,89,98 63/00-03,10-13,22,23,(30),42 62/18,29,39,49.

Parmelia borreri: Probably very rare. On small elm in hedgerow.
63/41 Potter Heigham FD.

Parmelia caperata: Quite widespread, but rarely common except in some woods in North Norfolk and in some Broadland carrs, absent from the Fens. On alder, hazel, beech, walnut, willow, apple and lime. Probably now most frequent on ash. In parkland, on hedgerow trees and in woods. On carstone in rockery at Sandringham House. Recorded from 53 squares, 75.7%
53/61-64,70-72,74,80-84,90-93 52/78,88,89,98,99 63/00-04,10-14,20-24,30-33,40-42 62/00,09,18,19,28,29,38,39,49.

Parmelia conspersa: Very rare. On wooden bier.
52/99 East Wretham Church one thallus PWL and CJBH 1983.

Parmelia elegantula: Rare. On sycamore and elm in parkland.
52/89 Bodney on elm PWL 1982, 63/03 Gunthorpe Park PWL 1975.

Parmelia exasperatula: Very rare. On old ash in parkland.
63/00 Kimberley Park FR.

Parmelia glabratula: Common. On beech, ash, sycamore, apple, oak, elder etc. In woodlands, hedgerow trees and in parklands. Recorded from 50 squares, 71.4%
53/51,60-62,64,70-72,81-84,90-93 52/59,78,79,89,98,99 63/00-04,10-14,20-23,30,31,33,40-42,51 62/09,18,19,28,29,39,49.

P. glabratula ssp. **fuliginosa:** Frequent. On acid stone and tile. Recorded from 29 squares, 42.8%
53/71-73,80,82,84,91,94 52/89,99 63/01,02,11,13,14,23,24,30,32,33,40-42,51 62/09,18,19,28,39.

Parmelia mougeotii: Rather frequent, probably more so now than in the past as it was not recorded by Turner or Smith. On acid stone, tile and slate. Recorded from 22 squares, 31.4%
53/60/90 52/79 63/00-03,10,12,13,20,22,32,33,40 62/07,09,17-19,38,49.

Parmelia perlata: Local and rather uncommon. On ash and oak. Largely restricted to the north and east of the county with one locality in Breckland (Starston Carr). Apparently a declining species as now absent from several of its post 1960 sites

eg. Horsford. Considered to be restricted to zone 8 and above and therefore sensitive to air pollution. Recorded from 14 squares, 20%
53/71,83,84 52/89,98 63/03,04,12-14,21,30 62/(09),49.

Parmelia pulla: Probably rare. On slate and granite.
62/39 Raveningham Church CJBH and PC 1986.

Parmelia reticulata: Very rare. On oak pollard in oak pasture woodland.
63/04 Hull Wood PWL and FR 1972.

Parmelia revoluta: Fairly frequent. On oak, ash, willow, hazel and poplar especially in damp woodland. Recorded from 27 squares, 38.5%
53/70,71,80,91-93 52/88,89,99 63/00,01,03,04,11-14,21,22,30,31,33,40,42 62/07,18,29.

Parmelia saxatilis: Occasional but locally abundant as at Yaxham Church, always sterile. On oligotrophic bark and also on acid stone. Recorded from 17 squares, 24.2%
53/62,71,72,84 52/79 63/01,03,04,11,14,21,42 62/28,38,39.

Parmelia subaurifera: Occasional to locally frequent. Mainly on willow and elder, but also ash, hazel and elm. Most often found in woodland. Recorded from 33 squares (28 post 1960), 47.1%
53/61,64,70,71,72,74,82,84,90,93 52/78,79,89 63/03,04,10,(11),12,13,(14,20,21),22,30-32,40-42 62/(09),17,18,29.

Parmelia subrudecta: Frequent. On sycamore, willow, oak, hazel, ash, walnut, poplar, etc. in hedgerows, parkland and well-lit woodland. Recorded from 58 squares, 82.8%
53/51,62-64,70-72,74,80-84,90-94 52/59,68,78,79,89,98,99 63/00-04,10-14,20-23,30-33,40-42,51 62/07-09,18,19,28,29,39,49.

Parmelia sulcata: Widespread and abundant except in the Fens. On oak, ash, elm, willow, alder, hazel, beech, sycamore, plane etc. Also sometimes on wood and on acid stonework. Formerly fertile eg. at Wheatfen (63/30) SAM 1936, and Holt (63/03) EMH.
Recorded from 65 squares, 92.8%
Not recorded from 53/40,41,50 52/69 63/50.

Parmelia tiliacea: Now very rare. The only modern record is in parkland at the base of an ash.
53/80 Hilborough Park PWL 1981, (63/20) Lakenham ENB, Dunston KT.

Parmelia verruculifera: Occasional. On acid horizontal stone, also rarely on wood as at Sustead Church. Recorded from 13 squares, 18.5%
53/62,64,83,84,94 52/69 63/01,11,13 62/07,09,17,39.

* **Parmeliopsis aleurites:** Extinct though still present in Suffolk. On wood.
(62/49) Toft Monks on a pound CJP&JP ca 1800.

Peltigera didactyla: Occasional on dunes, gravel pits and heaths. Recorded from 9 squares (6 post 1960), 12.8%
53/81,84 52/78,89 63/01,04,(30) 62/(08,09).

Peltigera lactucifolia: Occasional. On grass heath, old airfields, and other open habitats.
Recorded from 14 squares, 20%
53/61,62,64 52/79,89 63/01,03,04,10,11,(14),42 62/18,39.

Peltigera membranacea: Occasional. On lawns, grass heaths, banks and dunes. All material critically examined seems to be this taxon, but there is a possibility that some of these records are referable to *P. canina.* This should be searched for especially near the coast. Recorded from 18 squares (14 post 1960), 25.7%
53/61-64,71,74,84,91 52/(78),88 63/01,04,10,11,21,(23) 62/(08,09).

Peltigera praetextata: Apparently rare. Recorded only on dunes.
53/74 Holme next the Sea SAM 1971.

Peltigera rufescens: Occasional. On dunes, gravel pits, heaths and disused railways. Recorded from 9 squares (8 post 1960), 12.8%
53/63,64,84 52/79,89 63/01,04,(11),31.

Pertusaria albescens: Frequent. On trees especially on sycamore, ash, and oak in parks and woods. In Eng.Bot. "The present specimen was sent to us from Yarmouth by Mr. W. Borrer who observes that the bitter flavour of *L. fagineus* (*P. amara*) is not found in this species". Recorded from 12 squares, 17.1%
53/62,64,71,82 52/68,89,99 63/01,11,12,32 62/29.

P. albescens var. **corallina:** In similar habitats to the type. Recorded from 17 squares, 24.2%
53/64,80,84,90,92,93 52/89,99 63/00,12,21,(22) 62/09,19,29,38,39.

Pertusaria amara: Frequent away from areas of intensive agriculture. On sycamore, ash, oak, etc. Also sometimes on brickwork and acid stone eg. at Guist Church 63/02, and Bylaugh Park 63/01. Recorded from 50 squares, 71.4%
53/60,62,64,70-72,74,80-84,90-94 52/78,89,98,99 63/00-04,10-14,21-24,30-33,41,42 62/08,09,18,19,28, 29,38,39,49.

Pertusaria coccodes: Local. On the oligotrophic bark of old oaks in parks and occasionally woods and hedgerows. On sandstone tombstone at Rougham. Recorded from 30 squares, 42.8%
53/62,64,71,72,80-84,90,92,93 52/89,99 63/00-04,10-14,22 62/18,29,38,39.

Pertusaria flavida: Uncommon. Mostly on old oaks in parkland, usually in less polluted sites.
53/62 Sandringham BLS 1968, 80 Hilborough Park FR 1970, 52/99 Merton Park FR 1969, 63/10 Ketteringham Park FR 1969, 12, 14 Felbrigg FR 1970, 62/29 Fritton FR.

Pertusaria hemisphaerica: Uncommon. On oligotrophic bark, especially oak,

in woodland and parkland. Recorded from 8 squares, 11.4%
53/62,71 52/99 63/00,03,04,13,14.

Pertusaria hymenea: Uncommon. On oligotrophic bark especially on oaks in parkland and woodland. On stone at Hevingham Church 63/12. Recorded from 7 squares, 10%
53/62,93 63/03,04,12,14 62/28.

Pertusaria leioplaca: Uncommon. On the smooth bark of hornbeam, hazel, beech, walnut and oak. Mostly in woodland. Recorded from 9 squares, 12.8%
53/72,82 63/01,03,04,10,14 62/28,29.

Pertusaria multipuncta: Rare. On trees in woodland.
63/03 Swanton Novers FR.

Pertusaria pertusa: Common. On sycamore, ash and oak in woodlands and parkland. Recorded from 32 squares, 45.7%
53/62,71,72,81,82,84,92,93 52/89,99 63/00-04,10-14,20-24,31 62/08,18,19,28,29,38.

\+ **Pertusaria velata:** As this is always a rare corticolous species of ancient woodlands and all the Norfolk records are from stonework the records must be considered erroneous.
(63/12) Cawston Church JES, Hevingham Church Rev. Alderson, (62/17) Scole Inn DT.

Petractis clausa: Very rare. On chalk pebble in Breckland grassland.
52/78 Weeting Heath PWL 1972 not seen since, also recorded from Thetford Heath in vc. 26.

Phaeophyscia nigricans: This species appears to be very rare in contrast to its abundance in other parts of East Anglia. Possibly more frequent than the few records suggest.
52/79 Foulden Church on wall top PWL 1975, 62/39 Raveningham Church on wall top, Chedgrave Church on black limestone table tomb CJBH and PC both 1986.

Phaeophyscia orbicularis: Abundant. On eutrophicated limestone, also on brickwork, tile and sandstone. Occasional on wood especially near the coast. Also on eutrophicated bark of elder and elm. Recorded from 64 squares, 91.4%
Not recorded from 52/59,98 63/24,50 62/07,09.

* **Phlyctis agelaea:** Extinct. Formerly on bark. As *Lichen agelaeus* in Eng.Bot. "This obscure lichen is found by Mr. Turner about Yarmouth and it is said by those gentlemen to be not uncommon on the barks of trees."
(63/10) Earlham KT ca 1850, (11) Ringland on beech SAM 1937 HbNWH, (20) Framlingham K&W, (21) Stratton Strawless K&W, (30) Wheatfen K&W, (50) Yarmouth DT.

Phlyctis argena: Common. Especially on the smooth bark of sycamore, beech and ash, also on oak and willow. In woodland, parkland and on hedgerow trees. Recorded from 45 squares, 64.2%
53/60,62,64,70,71,73,80-83,92,93 52/68,78,79,89,98,99 63/00-04,10-14,21-24,30,32,33,40-42 62/08,18,19,28,29,49.

Physica adscendens: Abundant. On limestone, brick, tile, asbestos and also on bark especially on elm and elder. On wood in eutrophic situations. Occasionally fertile. Recorded from 67 squares, 95.7%
Not recorded from 53/41 52/49 62/07.

Physica aipolia: Uncommon. On maple, ash and elm in parklands and rarely in hedgerows.
53/64 Hunstanton Park PWL and FR, 80 South Pickenham Park PWL 1976, 84 Holkham Park PWL and FR, 93 Wighton in hedgerow PWL 1975, 63/(11) Costessey ? KT 1858, Drayton SAM 1936 HbSAM, 14 Sheringham Park PWL and FR, 22 Westwick Park FR, 62/39 near Brooke, in hedgerow PWL and FR.

Physcia caesia: Very common. On horizontal stone, especially limestone, asbestos, cement and tile. Occasionally on flints on the coast and on Breckland heaths. Sometimes on wood and occasionally on bark in dusty eutrophic situations. Rarely fertile as at Taverham Church 63/11. Recorded from 67 squares, 95.7%
Not recorded from 52/59,89 62/07.

Physcia dubia: Has been overlooked in the past, apparently quite common. On tops of tombs etc. in eutrophic situations. Recorded from 7 squares, 10%
53/51,60,71,72 62/19,39,49.

Physcia tenella: Very common. On sandstone, limestone, cement and asbestos in eutrophic situations, also on the eutrophicated bark of elder, elm etc. Occasionally fertile. Recorded from 55 squares, 78.5%
53/40,51,52,60-62,64,70,72,80-82,84,90-94 52/59,68,69,78,79,89,98,99 63/00,01,04,11-14,20,21,23, 24,31-33,40,42,50 62/07-09,17-19,27-29,38,39,49.

Physconia distorta: Occasional on the eutrophicated bark of maple, ash, elder and elm. Recorded from 31 squares (28 post 1960), 44.2%
53/51,62,64,71-74,84,90,93 52/79,89,98 63/00,02,04,(11),12,(21),22,23,30,31,33,42 62/(08),09,18,19,29,39.

Physconia enteroxantha: Rare. On ash in parkland.
53/80 Hilborough Park FR 1970.

Physconia grisea: Frequent. On eutrophicated limestone, occasional on eutrophicated bark. Rarely fertile. Recorded from 64 squares, 91.4%
53/40,50-52,60-64,70-74,80-84,90-94 52/68,79,88,89,99 63/00-04,10-14,20-24,30-33,40-42,51 62/03,09,17-19,27-29,38,39,49.

Physconia perisidiosa: Uncommon. On eutrophic bark of sycamore, ash, elder and elm in parkland and in hedgerows. Also occasionally on stone in eutrophicated situations. Recorded from 7 squares, 10%
53/64,80,90 63/00,13,33 62/29.

Placynthiella oligotropha: On peaty sand amongst moss.
63/41 Winterton Dunes CJBH and PC 1986.

Placynthiella uliginosa: Fairly frequent. On peaty soil and old rotting wood. Recorded from 18 squares, 25.7% The usually sterile taxon *Placynthiella icmalea*

almost certainly occurs but has been overlooked in the present studies.
53/62,70,82,84,91,94 52/99 63/03,04,(11),12,14,21,30,32,33 62/18,29

Placynthium nigrum: Rare in contrast to Suffolk, where it is not uncommon. On horizontal limestone.
53/92 Gately on stonework of railway bridge PWL 1984, 62/27 Brockdish on table tomb PWL, 63/02 Foulsham Church PWL 1989, 63/10 Marlingford Church CJBH JGG and PC 1986.

Platismatia glauca: Rather frequent. On oligotrophic bark, especially on the horizontal boughs of oak and willow in woods and parks. Occasionally also on heather or on the ground on heaths and dunes, eg. Blakeney Point. Recorded from 19 squares, 27.1%
53/62,63,71,72,82,93 52/88,89,98,99 63/03,04,12,13,21,22,30,31 62/18.

* **Polyblastia gelatinosa:** Rare, possibly extinct. On consolidated sand between stones and shingle.
(53/84) Scolt Head Island PWJ 1959.

* **Polychidium muscicolum:** Extinct. Formerly on moss on dunes.
(63/51) Hemsby Marrams DT ca 1800.

Polysporina simplex: Uncommon. On brickwork also probably overlooked on granite.
52/69 Southery Church on granite PWL and CJH 1984, 63/01 Lyng Church on granite tombstone PWL 1984, 04 Morston Church on brick PWL and BJC 1971, 20 Yelverton Church CJBH and PC 1986, 22 Brampton Church on brick, 62/18 Burston Church PWL 1975 as var. *crustosa*.

Porina aenea: Rare in woodlands. On smooth bark. The records from Spixworth suggest that it may have been more widespread and on a greater range of trees in the past.
52/98 Shadwell Park in woodland on beech PWL 1972, 63/03 Swanton Novers Great Wood on hazel PWL 1973, (21) Spixworth on elder and maple SAM.

* **Porina borreri:** Extinct. Formerly on bark.
(63/21) Spixworth SAM 1940 (associated with *Opegrapha vulgata*).

Porina leptalea: Very rare. In damp sheltered woodland.
63/04 Cley Park Wood on rhododendron PWL and BJC 1973.

Protoblastenia rupestris: Frequent. On hard limestone especially on table tombs, rarely on chalk pebbles at Weeting Heath. Recorded from 37 squares, 52.8%
53/40,41,50,60-62,64,71-74,83,84,90-94 62/78,79,99 63/00-02,10-12,20,21,23,40,41 62/08,09,17-19,28,38.

Pseudevernia furfuracea: Occasional. Mostly on acid bark especially of oak in parkland, pasture and open woodland usually on horizontal branches. Also on heather and rarely on the ground eg. Sparham Pits 63/01. Also recorded on sacking and wood. Recorded from 11 squares, 15.7%
53/62,70,83,91,93 63/01,03,(11),12,21 62/09.

Psilolechia lucida: Extremely common. On vertical surfaces of acid stone and brickwork, often dominating large areas, rare on soil under tree roots eg. Cottage Wood Northrepps 63/24. Recorded from 67 squares, 95.7%
Not recorded from 52/59 63/50,51.

* **Psoroma hypnorum:** Extinct. Formerly on coastal dunes.
(63/51) Hemsby Marrams DT.

Psorotichia schaereri: Apparently very rare on shaded mortar.
63/00 Ruins of the original Kimberley Hall PWL 1984.

Pycnothelia papillaria: Very rare and probably a declining species. On damp peat amongst heather
63/12 Cawston Heath PWL 1974, also recorded by DT in ca 1805, (11) Felthorpe KT 1849, (21) Mousehold JES, Stratton Strawless DT, (50) Yarmouth DT.

Pyrenula chlorospila: Very rare. In pasture woodland on beech.
63/14 Felbrigg Great Wood FR 1970, PWL 1979.

Pyrrhospora quernea : Occasional. On the bark of beech, ash, walnut and oak. In woodland, parkland and trees in pasture. Always sterile. Recorded from 28 squares, 40%
53/60,62,64,71,80,84,92 52/78,89,98,99 63/00-04,10,12,14,21-23,30 62/08,09,18,28,29.

Ramalina baltica = Ramalina canariensis Steiner**:** Occasional. In exposed sites such as parkland and near the coast on sycamore, ash, also on walnut and poplar. Sometimes on the north facing walls of churches near the coast. Recorded from 23 squares, 32.8%
53/64,70,82,84,92-94 52/89,98 63/02,03,10,11,13,14,22,23,33,41,42,51 62/08,19,39.

* **Ramalina calicaris:** Extinct
(63/12) Marsham Miss A.M. Barnard mid 19th century HBNWH, (63/20) near Norwich VCH, (21) Stratton Strawless Woods K&W 1934, (20) Wheatfen Broad on ash SAM 1936.

Ramalina farinacea: Common. In parkland and on hedgerow trees especially sycamore, ash and elm, less often on maple, walnut, poplar, oak, willow and lime. Occasionally on north walls of churches especially near the coast, rarely on wood. Absent from areas of intensive agriculture. Recorded from 55 squares, 78.5%
53/60,62,64,70-74,80-84,90-94 52/68,78,79,89,98,99 63/00-04,10-14,22-24,30-33,40-42,51 62/08,09,17-19,28,29,38,39,49.

Ramalina fastigiata: Occasional. On sycamore, ash, walnut and poplar in exposed situations such as parkland and near the coast. Recorded from 15 squares, 21.4%
53/60,(62),83,94 63/02,03,(11),13,22,(30),33,(41),42 62/19,29,39.

Ramalina fraxinea: Now very rare but once apparently common. One of the species that has suffered most from the effects of air pollution. 19th century and early 20th century material is luxuriant and abundantly fertile. Modern specimens

are stunted and either sterile or only sparsely fertile. Modern records are on sycamore. Post 1960 records are :
63/02 near Guist PWL and FR still present 1984, 11 Attlebridge on roadside tree PWL 1984, 62/08 Bressingham Gardens PWL still present 1984.

Ramalina lacera: Uncommon but locally abundant. Mostly on the north walls of churches near the coast, rarely on trees especially elm as at Wighton.
53/73 Bircham Tofts AM, 83 Egmere Church on ruins PWL, 93 Wighton on elm PWL 1975, 63/23 Roughton Church PWL, 33 Happisburgh Church PWL, Witton Church PWL 1975, 40, 42 Horsey Church and Waxham Church PWL, 62/19, 49 Burgh St Peter Church PWL.

+ **Ramalina pollinaria:** All records for this species are probably errors for *R. farinacea* or *R. baltica.*

Ramonia chrysophaea: Very rare. On elm and oak in damp shady woodland.
63/03 Swanton Novers Great Wood on nearly dead oak associated with *Hypnum cupressiforme*, *Dimerella diluta* and *Lepraria incana* PWL and FR 1974 first British record, 11 Honingham Park on elm *Ulmus carpinifolia* associated with *Bacidia rubella* and *Metzgeria furcata* PWL 1975.

Rhizocarpon concentricum: Rare. On marble.
62/39 Geldeston Church on tombstone PWL and PWJ 1983.

Rhizocarpon constrictum = R. richardii (Lamy ex Nyl.) Zahlbr.: Apparently rare. On low shingle areas above high water. Not seen by me.
63/04 Blakeney Point B&B.

Rhizocarpon geographicum: Uncommon. Possibly more frequent than formerly as there are no pre 1960 records. On tile and slate roofs often covering large areas.
63/01 Lenwade on chapel PWL 1981, 11 Honingham Church PWL 1975, 14 Sheringham Park PC and CJBH 1988, 40 Acle Church PWL, 41 Mautby Church PWL, 51 Caister Church PWL 1974.

Rhizocarpon obscuratum: Occasional on acid stone including flint and brick. Recorded from 12 squares, 17.1%
53/64,81,84,94 63/01,04,11,12,31 62/19,39,49.

+ **Rinodina conradii:** The only record for this species is from Thetford Warren, Norfolk. This locality although in the administrative county of Norfolk is vc 26, West Suffolk. Probably once occurred on warrens in Norfolk.

Rinodina exigua: Uncommon. On elms in parkland.
53/74, 63/03, 04, (21) Spixworth SAM 1940, 62/18.

Rinodina gennarii: Fairly frequent. On limestone and occasionally brick, usually on horizontal surfaces. Recorded from 18 squares, 25.7%
53/51,60,62,72,74,84,93 62/68,69 63/02,04,11,31,32,41 62/08,18,49.

* **Rinodina roboris:** Extinct. There is a specimen from Yarmouth, Norfolk in the HbBM. However I have not been able to trace any other records which is surprising as the species occurs just over the border at Sotterley Park in Suffolk.

Rinodina teichophila: Uncommon. On acid stone work of tombs and walls.
53/71, 74 Titchwell Church, 84, 63/04.

Sarcogyna regularis: On a variety of calcareous substrates including hard limestone, concrete and shells. Recorded from 9 squares, 12.8%
53/62,64,74,84,93,94 52/79 63/01,03.

Sarcopyrenia gibba: Only recently recognised in the county. On basic stone.
63/20 Yelverton Church on marble CJBH and PC 1986, 40 Reedham and Freethorpe Churches CJBH and PC 1985, 62/28 Redenhall Church CJBH and PC 1986, 29 Brooke Church CJBH and PC 1986, 39 Chedgrave and Hedingham Churches CJBH 1985, 49 Thorpe and Haddiscoe Churches CJBH 1985.

Schismatomma cretaceum: Rare. On ancient oaks and elms in woodland.
53/93 Thursford Wood on oak PWL and FR 1977, 63/03 Gunthorpe Park on elm PWL 1975, 04 Hull Wood on oak PWL and BJC 1973.

Schismatomma decolorans: Frequent. On the dry bark of sycamore, ash, walnut, hornbeam, oak, lime and elm. In parklands, meadows and well lit woodland. Recorded from 46 squares, 65.7%
53/60,62,64,70-73,80-82,84,92,94 52/68,89,98,99 63/00-04,10-14,20-24,30-33,40,41 62/08,09,17-19, 28,38,39,49.

Scolicosporum umbrinum: Occasional. Mostly on acid stone in churchyards and on walls in urban areas. Recorded from 10 squares, 15.7%
53/63,81,84,92 63/04,20,41 62/18,19,39,49.

Solenospora candicans: Very rare. On limestone blocks in church wall.
63/20 Eaton Church PWL 1974.

Squamarina lentigera: Rare. Confined now in Britain to the Breckland of Norfolk and Suffolk where it occurs in broken turf in chalk grassland.
52/78 Weeting Heath locally frequent in the southern compartment EAE 1958, PWL 1972, (88) Thetford Warren which is in vc. 26. It used to occur on the sides of chalk pits on the warren; this area is now a golf course.

(Stenocybe septata): Uncommon. On holly in oak pasture woodland.
53/93 Thursford Wood PWL, 52/98 Merton Park FR 1st record, 63/03 Swanton Novers Great Wood PWL 1975, Pond Hills Edgefield PWL.

Stereocaulon nanodes: Locally very frequent. On brick or acid stone, mostly in urban areas where it occurs on walls.
63/11 Hellesdon PWL 1973, 20 Norwich Bracondale PWL 1973, 21 Hellesdon PWL, 62/09, 18 Dickleburgh Church PWL.

Stereocaulon vesuvianum: (Fig. 5) Rare though locally abundant in one or two sites. Likely to be threatened by habitat destruction in due course as it mostly occurs on the corroded iron of seldom used railway track rails.
53/91 Hoe PWL 1984, 92 Gately PWL 1984, 63/01 Lyng on tombstone, 02 Whitwell PWL (site removed in 1984).

Fig. 5 *Stereocaulon vesuvianum* on railway chair, Whitwell.

Strangospora moriformis: Very rare. On wood.
53/84 Scolt Head Island on decaying wood of flower tub PWJ 1961 HbBM.

Thelomma ocellatum: On wood.
63/42 Waxham Church on gate, Sea Palling on gate, both CJBH and PC 1986.

Thelotrema lepadinum: Very rare. In parkland and woodland on oak and small-leaved lime. Considered by Rose to be an old woodland indicator.
63/03 Swanton Novers Great Wood PWL 1973, on oaks in a small wood south of Hull Wood Glandford PWL 1973, (63/11) Costessey Park WJH, 13 Blickling Park on huge small-leaved lime pollards FR 1972.

Toninia aromatica: Occasional. On calcareous stone on church walls, less often on tombstones. Recorded from 23 squares, 32.8%
53/41,51,60-62,83,84,93,94 52/69,79,99 63/01,02,04,11,22,23,31-33,41 62/18,39,49.

Toninia caeruleonigricans: Rare. On calcareous soil in broken turf.
52/78 Weeting Heath southern compartment EAE 1958, PWL 1972, 88 Theford Warren near the Lodge—in the administrative county of Norfolk but in vc 26 (West Suffolk) PWL, 89 Stanford Warren in chalkpit PWL.

Toninia lobulata: Very rare. On calcareous soil in broken turf.
52/78 Weeting Heath southern compartment S. R. Davey 1973.

Trapelia coarctata: Fairly frequent. On old brick, carstone, and other acid stone, often in rather damp situations. Work needs to be done on this genus to sort out the taxa in the county. Recorded from 17 squares, 24.2%
53/51,61,73,83,94 62/88 63/00,01,11-13,20,31 62/09,18,19,39.

Trapelia obtegens:
62/28 Redenhall on acid stone table tomb CJBH and PC 1986.

Trapelia placodioides:
63/40 Reedham Church on wall CJBH and PC 1985, 62/39 Raveningham Church on wall CJBH and PC 1985.

Trapeliopsis granulosa: Fairly common on soil and rotting wood in heathlands and acid woodlands. Some records on wood may refer to *Trapeliopsis flexuosa*. Recorded from 14 squares, 20%
53/62,63,91,93 52/79,99 63/04,11,12,30,41,42 62/(09).

Trapeliopsis pseudogranulosa: Apparently rare. In woodland.
63/03 Swanton Novers Great Wood on oak PWL HbNWH.

Usnea articulata: Rare. On sand over shingle at the coast, associated with *Polytrichum piliferum* and at Wells with *Bryoria fuscescens*. A surprising addition to the Norfolk flora, this species normally grows on trees and bushes in south west England. It does however grow on the ground at Braunton Burrows in Devon and the Point of Ayres in the Isle of Man. It is also known from two sites on dunes in the Netherlands. There is an old record by Eagle from the Suffolk Breckland at Wangford Warren. The specimen has not been traced but there is circumstantial evidence that it may have occurred on the ground in an inland dune system.
53/84 Gun Hill Burnham Overy PWL 1981, 94 East Hills Wells PWL 1976.

+ **Usnea ceratina:** Two records of this species from Felthorpe and Dunston by SAM have been redetermined as *Usnea subfloridana*. This species should be deleted from the Norfolk list.

Usnea hirta: Rare. On wood and bark.
(63/11) Felthorpe on old wooden gate SAM 1936, 30 Wheatfen on willow TDVS 1966, 42 Horsey on fence post FD 1974, (62/09) Old Buckenham on fallen ash and oak SAM 1950.

Usnea inflata = Usnea cornuta Körber**:** Rare on oak and willow in woodland. On heather in heaths.
63/12 Cawston Heath on heather PWL 1974, 21 Horsford on oak PWL and BJC 1973, 1975, 23 Frogshall Southrepps PWL and FR, 32 Barton Broad JGG 1968.

Usnea subfloridana: Fairly frequent especially near the coast. On acid bark of oak especially, but also birch, willow and on heather. Occasional on wood and dead marram. Sometimes still forming dense stands as at Sheringham Park and until ca 1975 at Horsford. Recorded from 22 squares, 31.4%
53/62,63,70,82,83,93 52/89 63/01,03,04,11-14,21,23,30-32,41,42 62/39,49.

Verrucaria aquatilis: Apparently rare. So far only found on flint pebbles in one clear stream, searched for elsewhere but not found.
52/89 Stream flowing into Stanford Water PWL and FR.

Verrucaria baldensis: Occasional. On rather hard limestone on churches and churchyard monuments. Recorded from 15 squares, 21.4%
53/51,61,83,84,90,91 52/99 63/02,23,33,40 62/18,19,28,49.

Verrucaria ditmarsica: Occasional. On flints below hightide level on fringes of saltmarsh, usually under seablite.
53/84 Scolt Head Island PWL and AF 1983, 63/04 Blakeney Point PWL and AF 1983.

Verrucaria glaucina: Fairly frequent. On limestone on churches and churchyard monuments. Recorded from 39 squares, 55.5%
53/51,52,72-74,81-84,90,91,93,94 52/69,78,79,88,99 63/01,02,04,10,11,13,20,22,23,30-33,40,41 62/08,17-19,29,39.

Verrucaria hochstetteri: Common. On limestone monuments and church walls. Recorded from 40 squares, 57.1%
53/40,41,61,64,70,72-74,82-84,90-94 52/69,78,88 63/01,03,10-13,20,23,24,30-33,42 62/09,17-19,38,39.

Verrucaria maura: Rather uncommon due to the lack of suitable habitats. A marine intertidal species found mostly on flints including those incorporated into concrete.
53/63 Snettisham PWL, 74 Titchwell, 84 Scolt Head Island, 63/04 Blakeney Point B&B.

Verrucaria muralis: Common. On limestone monuments and church walls, also rarely on consolidated chalky soil in Breckland. Recorded from 42 squares, 60%
53/50,51,60,61,63,64,71-74,80,83,84,90-94 52/68,69,88,89,99 63/00-02,04,11-13,20,23,30,33,40 62/07,09,18,19,28,29,39.

Verrucaria nigrescens: Abundant. On limestone, less often on mortar, concrete and asbestos. Also on flints in Breck grassland. Recorded from 66 squares, 94.2%
Not recorded from 52/59,88 63/50 62/07.

Verrucaria viridula: Common. Mostly on limestone, less often on mortar, concrete and asbestos. f. *tectorum* not differentiated. Recorded from 41 squares, 58.5%
53/51,52,60,70-74,81,83,84,90-94 52/68,69,79,89,98 63/01,02,04,10-13,23,30,32,33,40,41 62/07,08,17-19,28,49. Records of f. *tectorum* probably refer to *Verrucaria macrostoma.*

Xanthoria calcicola: Common. Mostly on stone, especially limestone but also asbestos, cement, concrete, brick, tile and rarely sandstone, generally in eutrophicated situations. Once on elm in *Xanthorion* community at Wighton 53/93. More common than *X. parietina* on stone. Recorded from 64 squares, 91.4%
Not recorded from 53/50,80 52/59 63/24,51 62/38.

Xanthoria candelaria: Common. On sandstone, limestone, concrete, cement, tiles and asbestos in eutrophicated situations. Also on wood and trees especially ash and elm, as a component of the *Xanthorion* Only occasionally fertile as at Foulden 53/70.

Recorded from 63 squares, 90%
Not recorded from 53/40,41,50,52,61 52/78,98 63/51.

Xanthoria elegans: Probably locally frequent in urban areas, but rarely recorded because of its habitat preference. On modern cement tiles and concrete. Searched for in similar habitats in rural areas but not found except at Wroxham.
63/10 University of East Anglia on concrete PWL, 21 Hellesdon PWL 1974 first record, 31 Wroxham PWL.

Xanthoria parietina: Common in eutrophicated situations. On both calcareous and acid stone, also leather, asbestos, cement, concrete, tiles etc. On stabilised shingle at coastal sites near the high water mark. Frequent as a conspicuous member of the *Xanthorion* on ash, elm, sycamore, maple etc. Especially abundant on shrubby seablite on the coast. Recorded from 68 squares, 97%
Not recorded from 52/59 62/07

Xanthoria polycarpa: Common. In eutrophic situations on elder, less often on elm and other tree and shrub species. Occasional on sandstone eg. at Horsford Church. Recorded from 25 squares, 36%
53/64,71,72,82-84,92-94 63/01,03,04,10-12,21,24,30,31,40,42 62/09,17,29,39.

Acknowledgements
In addition to the acknowledgements set out in the first part of this paper, I would like to thank Dr Brian Coppins for commenting on the manuscript in its later stages and helping with nomenclatural problems.

References
A full list of published references used to compile the systematic list appeared in last year's *Transactions* (Lambley, 1988). Those cited in the present paper are given below.

Bloomfield, E. N. 1905 Lichens of Norfolk and Suffolk. *Trans. Norfolk Norwich Nat. Soc.* **8**, 117-137.
Cannon, P. F., Hawksworth, D. L. & Sherwood-pike, M. A. 1985 *The British Ascomycotina. An annotated checklist.* Kew: Commonwealth Mycological Institute.
Crombie, J. M. 1901 Lichenes (Lichens) in *The Victoria History of the Counties of England, Norfolk* (H.A. Doubleday ed.) **1**, 70-72 Westminster: Constable.
Lambley, P. W. 1988 The lichen flora of Norfolk. *Trans. Norfolk Norwich Nat. Soc.* **28**(1), 13-32.
Laundon, J. R. 1970 Lichens new to the British Flora: 4. *Lichenologist* **4**, 297-308.
Smith, J. E. & Sowerby, J. 1790-1814 *English Botany.* London: J Sowerby.
Turner, D. & Borrer, W. 1839 *Specimen of Lichenographica Britannica.* Yarmouth: 'for private circulation'.
Turner, D. & Dillwyn, L. W. 1805 *The Botanists Guide through England and Wales.* 2 vols London: Phillips and Fardon

THE LICHENS OF NORFOLK: ERRATA—In the first part of this paper that appeared in last year's *Transactions*, two errors have been pointed out. References to works by Turner and Borrer and by Turner and Dillwyn were incorrectly given in the list on p. 32. The correct versions are cited above. Also in the acknowledgements reference was made to Samuel Manning. In fact Sam Manning's first name is Stanley and we apologise to him for this mistake. As the editor read the proofs of this paper, on behalf of Peter Lambley who was abroad, he accepts full responsiblity.

THE DISTRIBUTION AND STATUS OF NEWTS IN NORFOLK

John Buckley

77 Janson Road, Southampton.

Introduction

All of the three species of newt native to England have been found in Norfolk but one of these, the palmate newt *Triturus helveticus* (Razoumowski), has not been recorded with certainty in recent decades (Buckley, 1975). The great crested or warty newt *Triturus cristatus* (Laurenti) and the smooth or common newt *Triturus vulgaris* (Linn.) are well within their geographical range in Norfolk and are found throughout the county. The maps presented in this paper show the distribution of Norfolk's newts on a tetrad basis for the first time and it is hoped that they will act as a stimulus for further recording. The paper also provides information for interested persons to be able to find and identify newts within the county.

Identification and habits

European newts are tailed amphibians (urodeles) belonging to the genus *Triturus*. This genus is part of the family Salamandridae to which the more terrestrial urodeles belong. Newts have a long body and tail and four short legs for locomotion. Whilst they superficially resemble lizards they can easily be distinguished from reptiles. The skin of newts is naked, totally devoid of any scales which are especially clear on a reptile's head. The small warts on the skin of the great crested newt give rise to its other common name. In a similar way the smooth newt has a smooth skin as does the palmate newt. Newts depend on water for breeding and although they can range widely between breeding seasons and before maturity, they are usually found near pools and ponds. Hibernation usually takes place on land but some individuals overwinter in the water.

In the early spring adults return to the water for the breeding season which lasts for a few months. Distinct changes in appearance take place especially in the males. The texture of the skin which is dry and often velvety or matt in newts living on the land becomes more absorbent to water and appears more glossy. Colours and markings become more distinct although to some extent smooth and palmate newts are able to vary their colour with their background. The most dramatic change of all occurs in the males of all species which develop growths of skin to form a crest along the back of the body and tail and a deepening of the underside of the tail. This development varies in size and form in each species. It develops soon after the return to water and is absorbed almost completely after the breeding season is over. The main function of the crest is for display in front of the female during courtship. As a result of courtship behaviour the female takes up a spermatophore deposited by the male and hence fertilization is internal. The eggs are laid singly by the female usually on the leaf of a water plant or on a blade of submerged grass which is folded around the egg. When a pond contains little or no vegetation the egg may be stuck to sticks, dead leaves or other objects in the pool.

In due course the eggs hatch into small larvae. The form of the larvae in all species is similar. There are three pairs of external gills and a crest above and below the tail. The fore legs develop first and then the hind ones. Metamorphosis usually takes place when the larvae are a few months old. Maturity is reached in two or three years and during this period the young newts are terrestrial in their habits.

Trans. Norfolk Norwich Nat. Soc.
1989 **28**(3), 221-232.

Fig. 1 Adult male great crested newt.

The general biology of these newts is described in detail in Smith (1951), Steward (1969) and Frazer (1983).

The great crested newt is the most distinctive of the three species. It is a large newt, males reaching a length of 140 to 150 mm (5.5 to 6 inches) and the females slightly larger. The skin is rugose and the basic coloration is very dark brown or black. During the breeding season the body shows a fairly large number of black blotches dotted irregularly over the back and sides of the body and the anterior part of the tail. The sides of the head and body are sprinkled with white markings. The male has a white stripe running medially along each side of the tail and this is much more noticeable during the breeding season (Fig. 1). The male develops a high dorsal crest which extends from the back of the head to the tip of the tail except for a gap above the base of the tail. The crest is strongly indented over the head and body and smoother over the tail. The belly is yellow or orange, blotched with black, the lighter colour extending along the lower edge of the tail in females. Efts (sub adult newts) look like small versions of the female. Newly metamorphosed efts are 50 to 60 mm long and may grow to 80 mm by their first hibernation.

The eggs of the great crested newt are larger than those of the the other two species. They are about 2 mm in diameter and are surrounded by an oval shaped clear jelly-like envelope about 4.5 mm long. The eggs are a yellowish white in colour.

The fully developed larvae of this newt can be distinguished by size alone (length 50 to 80 mm) from the larvae of the smooth and palmate newts (40 mm). The undamaged tail tapers gradually to a long filament and there are often large dark spots on the sides of the larvae and especially on the tail (Fig. 2).

Fig. 2 Great crested newt larva.

The study of newt breeding sites by Cooke and Frazer (1976) shows that the great crested newt is usually found with the smooth newt as they favour the same sort of water chemistry but that the great crested has a preference for larger and deeper pools (at least 300 to 550 mm). All newts favour ponds with abundant aquatic vegetation but the great crested also seems to prefer those with a high proportion of open water. The terrestrial habitat near the pond is also of importance. Beebee (1977) studied the amphibians of dew ponds on part of the South Downs and found that this newt was only found in significant numbers where more than 5 ha of scrub were associated with suitable ponds. The types of body of water used by great crested newts for breeding are large field ponds, farm yard ponds, moats, flooded chalk, sand and gravel pits, meres, lakes and open static water tanks. Only very rarely are garden ponds utilized (Mathias, 1975; Beebee, 1979).

The smooth newt is about 60 to 100 mm (2.5 to 4 inches) long. The skin is smooth and outside the breeding season may look matt or slightly velvety. During the breeding season the male acquires a high vertebral crest running from the rear of the head almost to the tip of the tail, with a further crest along the lower edge of the tail (Fig. 3). The upper crest has an undulating edge, unlike the jagged crest of the the great crested newt. The hind toes of the males develop narrow fringes of skin on their edges. The basic body coloration is brown to olive brown with dark circular markings. The head, especially in the male, has five dark stripes, the outer one on each side passing through the eye. The belly is yellow to orange with dark blotches which are finer in the female. The female smooth newt is similar in appearance to the female palmate newt.

Fig. 3 Adult male smooth newt.

The eggs of the smooth and the palmate newt are of a similar size, being about 1.5 mm in diameter within a capsule 3 mm long . Both the eggs and young larvae of these two species are indistinguishable. The larvae grow to about 30 to 40 mm before metamorphosis. The undamaged tail tip comes gradually to a point and does not narrow into a filament.

Efts can be distinguished by careful examination of the vertebral stripe (Roberts, 1989). The vertebral stripe of the smooth newt eft begins high on the head and usually ends near to or at the pelvic girdle. It is more intensely pigmented at the anterior end and becomes weaker towards the posterior end. The stripe colour varies from yellow to deep orange but is commonly pale orange. The vertebral stripe of the palmate newt eft, on the other hand, starts at the base of the head or on the neck region and usually extends beyond the pelvic girdle. It is uniformly pigmented along its length and tends to be orange in colour , but the shade may vary from pale to deep orange.

A few species of newt not found in Britain breed whilst in their larval form. Such a condition is known as neotony. Partial neotony is the term used to describe the situation when individuals retain their larval form but their gonads fail to mature. It has been recorded in all the British newts but it is most common in the smooth newt. In recent years partially neotonous smooth newts have been recorded at Saxlingham Nethergate and from near Cringleford.

The smooth newt is rarely found in acid waters (lower than pH 6) and they tend to be found in metal rich water, particularly with a high calcium content. They favour pools large enough to support abundant aquatic weed but they do not need

Fig. 4 Adult male palmate newt.

to be as large as for the great crested newt. Unlike the great crested newt they utilize garden ponds as well as a range of larger bodies of water.

The palmate newt is the smallest species found in the British Isles. The total length of full grown males is about 70 mm (3 inches), and of females slightly more. During the breeding season the male develops complete black webs between the toes of the hind feet, a very low smooth crest and a short filament (1.0-7.0 mm) extending from the end of an otherwise abruptly truncated tail tip. A glandular pad running the whole of the length of the back increases in size to give a flattening of the back and an angular edge between the back and side of the body. The general body colour is pale olive to dark brown and the belly is pale straw to mid orange in colour. Darker markings on the tail consist of a median stripe with a row of prominent dark spots above and below it. A dark line on each side of the head runs through the eye. The top of the head has a marbled pattern (Fig. 4).

The female palmate (Fig. 5) is very similar in appearance to the female smooth newt but they can be distinguished by careful examination. The throat of the female palmate is white or translucent pink and hardly ever has a single dark spot on it. The throat of the female smooth newt, on the other hand, is rarely spotless and has on average about 20 spots. The tail tip of the palmate may have a short dark filament up to 1.5 mm in length but usually about 0.5 mm. The female smooth newt never has such a filament. The belly colour of the palmate is light yellow to mid orange and that of the smooth newt tends to be slightly darker, pale to mid orange. There are fewer belly spots (median 12.8 range 0-48) on female palmates than on female smooth newts (median 46.0 range 0-100),(Roberts, 1989). By using

Fig. 5 Adult female palmate newt.

a combination of characteristics it is possible to determine a female newt with reasonable certainty. In any event however it would be unsatisfactory to base a record of palmate newts in Norfolk on the identification of a single female.

The palmate newt in Britain has been described as a montane species (Smith, 1951; Steward, 1969) but the term was being used loosely since it was known to occur at sea level. Cooke and Ferguson (1975) examined records at the Biological Records Centre and concluded that it would be more accurate to state that the palmate is commoner in some upland regions and that it tends to be rare in lowland areas of Britain. The study by Cooke and Frazer (1976) showed that palmate newts prefer a different water chemistry to that selected by the smooth newt. Palmate newts were regularly found in water down to pH 4 and they preferred metal-deficient water especially water with a low potassium. The palmate newt is less common in hard water areas of the country and the reverse is true for the smooth newt. The palmate newt breeds in similar bodies of water to the smooth newt.

Although newts have been found active during mild spells in February and December they are most likely to be encountered between March and October (Table 1). Probably the best months for finding them are April and May when the adults have congregated at their breeding ponds. The three main techniques for finding newts during the breeding season are netting, torching and trapping. Netting requires the use of a strong pond net with a coarse mesh (2 to 5 mm) to catch the animals directly. The normal procedure during survey work is to net each pond for a fixed time in relation to its size, around the accessible parts, accumulating animals for later identification and release. Care should be taken not to disturb the

Table 1. The number of sightings of newts per month (data from all years 1960-1988) excluding hibernating individuals.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Smooth newt	0	1	20	40	33	16	13	17	11	6	0	2
Great crested newt	0	0	9	14	12	4	9	9	4	0	0	0

too much and to return all the material to the pond afterwards.This technique has the advantages of being able to be undertaken during the daytime and it allows for the proper identification of specimens. Torching involves searching shallow clear water with a powerful light beam during the evening or early part of the night, visiting all accessible parts of the pond and simply recording what can be seen. This technique is very good for finding great crested newt colonies but it can be hampered by turbidity, dense weed, and rainy or windy conditions. It is often difficult to identify small newts especially the females. Trapping requires the construction of traps and two visits to each pond once in the evening to set the traps and the next morning to inspect the catch. This method has the advantage of often being a very effective means of obtaining specimens for positive identification. It may be the only possible method for sampling some ponds where netting and torching are impossible. Further details about these techniques are given in the British Herpetelogical Society booklet "Surveying for Amphibians—a practical guide".

The great crested newt is strictly protected under the Wildlife and Countryside Act 1981 and a licence is required for the legal handling of specimens. A licence is needed for trapping or netting them but not for torching. An application form for a licence can be obtained from the licensing section of the Nature Conservancy Council.

Newts are less easy to find during their terrestrial phase but actively looking for them can be rewarding. Searching likely areas with a torch after dusk can be successful particularly on wet days. During the daytime newts may be found by searching under logs, discarded fabric and other objects where moisture is likely to be retained. It can also prove rewarding to look under debris at the bottom of trenches and other steep sided holes where newts might fall and be unable to escape.

Records and Distribution

Records sent to the Society and others since 1960 have been copied onto edge-notched cards for ease of storage and retrieval. The records are also held on 'Recorder', a computer package for biological recording, at Norwich Castle Museum. Post 1970 records have been plotted as tetrad (2 km x 2 km) maps. There has been no systematic attempt to survey the whole county for newts and to some extent the distribution shown by the maps may reflect the activity of recorders. There is certainly scope for our knowledge of the species' distribution to be extended and updated. Doubtful and unconfirmed records have been omitted from the maps together with some where the precise locality could not be determined. Full details have been supplied to the Biological Records Centre at Monks Wood.

The smooth newt is the more widespread of the two species known to still occur in the county but there are some 10 km squares in which it has yet to be recorded (Fig. 6). It is likely to be found wherever there are suitable terrestrial and aquatic habitats.

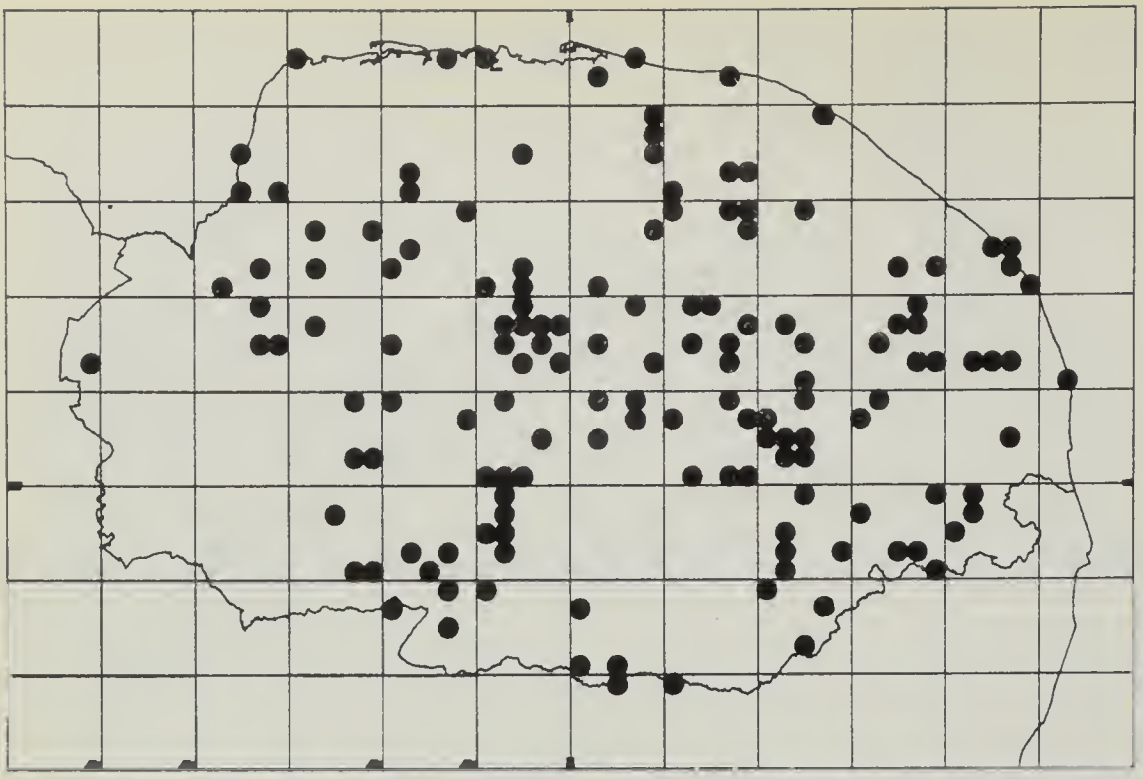


Fig. 6 Smooth newt. Post-1970 tetrad distribution map.

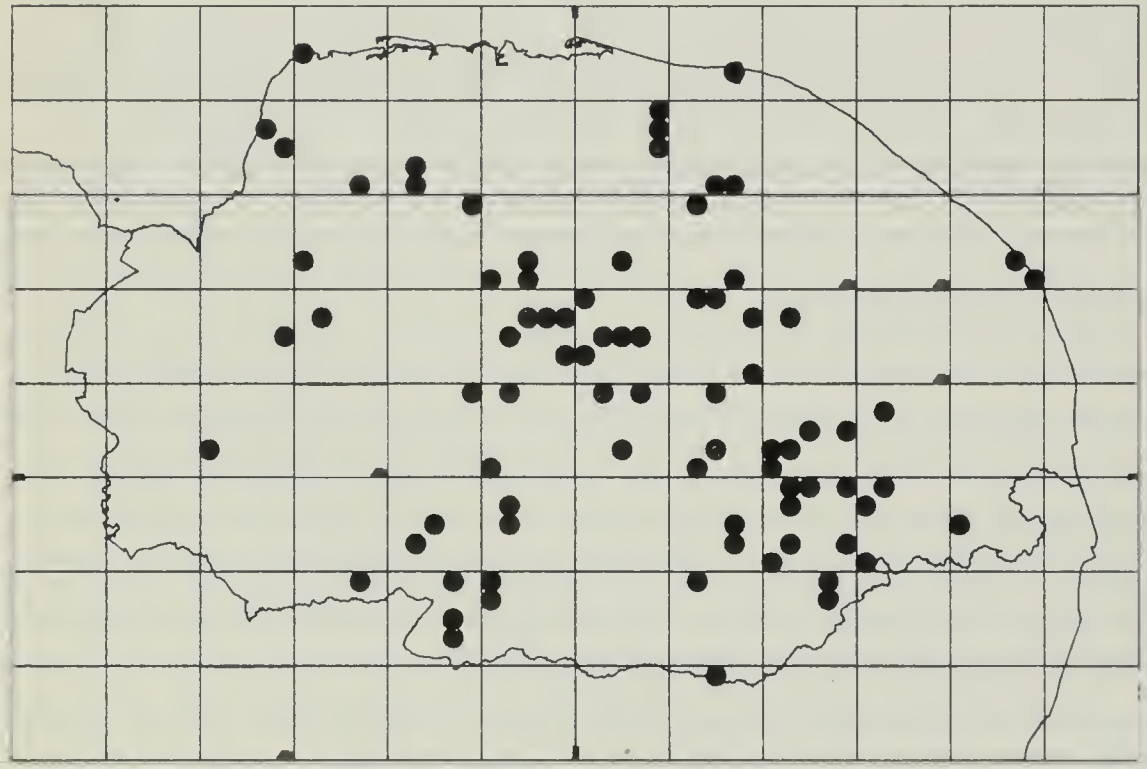


Fig. 7 Great crested newt. Post-1970 tetrad distribution map.

The great crested newt is found mainly in central and south east Norfolk and it is absent from Broadland. It is found in Breckland but seems to be rare in west and north Norfolk (Fig. 7). The lack of records from the Fens may simply reflect a lack of observers in the region.

There are no recent records of the palmate newt in Norfolk and the same is true for Suffolk (Jones, 1988). The 1967 record for Calthorpe Broad (Buckley, 1975) has not been confirmed and as it was based on individuals not in breeding condition, it must be considered as questionable. On the other hand there can be no doubt about E. A. Ellis' records for Herringfleet in the 1920s and Burgh Castle village on 31st May 1933. In his book on the Broads he mentions that the palmate newt had been taken from ponds at Brumstead (Ellis, 1965). No other details are known about these records except that in part of a manuscript dealing with amphibians he wrote "All three species have been found in a single pond at Brunstead" (presumably a typing error for Brumstead).

The thorough and detailed report on amphibians and reptiles in the area around Holt by Holmes (1952) provides evidence that the palmate newt occurred in that part of Norfolk. Again it has not been possible to confirm its continued presence.

Amphibians are very much easier to record than reptiles because in the spring time they assemble at their breeding pools often in large numbers. Systematic attempts should be made to try to fill some of the gaps in the distribution maps and at least determine whether the great crested newt and the smooth newt can be found in each of the county's 10km squares. There is also the remote possibility that palmate newts might be rediscovered in the county.

Changes in status and conservation

There can be no doubt that the great crested newt and the smooth newt have declined in abundance since the middle of the last century when Southwell (1871) commented upon their status. He recorded them both as common as he did the common toad and the common frog. Southwell (in Lubbock, 1879) described them both as frequent. Unfortunately most of the early references to the status of Norfolk's newts are very brief and not backed up by any field observations. At about this time the palmate newt was known only from F. Norgate's record at Sparham. It would seem that it was always a local and rare species only having been found at a few sites in the county. Had the palmate newt been commoner it is most likely that E. A. Ellis would have received information in response to his Nature's Byways article published in 1958. Now the palmate newt must be considered to be absent from Norfolk.

Ellis (1965) recorded the great crested newt as widely distributed in ponds and marsh dykes bordering the valleys of Broadland. It was not known to breed in any of the broads although it had been found in waterways closely and directly connected to them. The smooth newt was described as common in ponds and ditches throughout the district and occasionally in some of the quieter broads during the breeding season.

Beebee (1975) conducted a questionnaire survey into the status of the great crested newt in Britain. The nineteen correspondents in East Anglia provided information which suggested that in this region it was most frequent and that although the decline in status had begun before 1960, the rate of decline was becoming less. In retrospect it could be thought that the observers were being somewhat over-optimistic.

Cooke and Scorgie (1983) conducted a survey of the status of the commoner amphibians and reptiles in Britain. They used a questionnaire and asked recorders to give the status of the various species in 1980, the change of status since 1970, if any, and the reason for any change in status. The responses were then processed to give indices of abundance (range 0 to1) and changes of status (range -1 to +1) on a regional basis. In East Anglia the great crested newt was considered to be widespread but local and not common (index 0.47) , the smooth newt widespread and common or abundant (index 0.90) and the palmate newt generally absent or rare (index 0.25). The responses of the nine East Anglian recorders indicated that all newts had decreased in abundance, the great crested (index of change—0.67) more so than the palmate (index of change—0.20) or the smooth newt (index of change—0.15). This study found evidence of a severe decline in the great crested newt in East Anglia and therefore differs from Beebee (1975). Eighty five percent of the reasons given for the decrease in the abundance of the great crested newt were loss of suitable habitat. Other reasons given by recorders were pollution (5%), increased mortality (4%), and collection (6%). The situation was worse than previously thought.

The smooth newt has not declined to such a large extent as the great crested in England but it too will have suffered from the loss of habitat. The reasons given for the decline of smooth newts are much the same as for great crested. Reasons for an increase in the newts are fewer than for decreases and the essential difference between the two species is that the smooth newt is more able to utilize garden ponds than the great crested.

The great crested newt has probably always been less common than the smooth newt because it is more restricted in its choice of breeding pools. The general decline in the availability of newt breeding sites and terrestrial habitat is therefore likely to result in the loss of the great crested newt before the smooth newt. This appears to have happened in Broadland in the last few decades. There can be little doubt that the change of land use of many of the former grazing marshes to arable farming has resulted in the loss of the great crested newt as well as many other interesting species.

Elsewhere in Norfolk newt breeding sites have been lost to the sorts of changes in farming practice described by Bull (1988). The report on Norfolk ponds by Tuxworth, Crane and Morris (1985) was based on a study which used Ordnance Survey maps and the NNT's Phase 1 habitat survey. Study areas covering in total about twenty percent of the area of the county were chosen at random and about half were in each vice county. In about 1905 the study areas contained about 11,000 ponds and since then there has been a 74.4 % loss of ponds. In recent years the decrease has been most rapid. About 88% of the losses were attributable to "farming practice" which generally refers to the removal of field boundaries and the filling of associated ponds or to the filling of old marl pits located in the centre of fields. Urban growth accounted for 10% of the total loss. The Phase 1 habitat survey recorded a rather depressing picture of the remaining ponds. Most were graded as small (87.2%), eutrophic (95.3%) and of poor nature conservation value (87.5%). The loss of three quarters of Norfolk's ponds this century with the most rapid loss occurring in recent years points to a gloomy future for newts in the county.

As a result of his researches into the habitats of British amphibians, Beebee (1981) made a number of suggestions regarding the conservation of the herpetofauna. Firstly, garden ponds should be encouraged and owners induced to omit fish

from them since fish are major predators. Smooth newts usually colonise without the need of assistance, and the deliberate introduction of great crested newts and palmate newts might be considered if there are viable local ponds which can withstand the loss of a few adults. (The introduction of great crested newts now requires a licence). Secondly, local authorities should be encouraged to manage those ponds in their jurisdiction to the benefit of amphibians by keeping at least some free from fish and waterfowl, by not cleaning them out between February and September and by permitting the dense growth of vegetation rather than close mown grass around at least part of the pond. Finally and most importantly, farmers should be induced not only to refrain from the infilling of ponds but to leave around them as large an area as possible of rough scrub or open woodland. Fencing off livestock is also beneficial, though obviously successional changes which would lead to the total shading or silting up of the pool need to be prevented in some way. Management tailored to the needs of each pond could achieve the desired results.

Unfortunately, the reliance upon the goodwill of farmers, land owners and local authorities to protect wildlife habitats has been a conspicuous failure, and the Wildlife and Countryside Act 1981 which promised so much has been a disappointment. The species protection side of conservation has been grossly overdone whilst the protection of habitats remains weak and is all too often ineffectual. In Dorset there is currently the ridiculous situation where sand lizards and smooth snakes are being caught so they are not killed when their heathland habitat is destroyed to make way for housing or another DIY superstore. Although sand lizards and smooth snakes have been fully protected since 1981, they are now much rarer than a decade ago because the destruction of heathland has continued unabated. Great crested newts and smooth newts have been declining too and the only way to prevent the slide towards rarity and local extinctions continuing is for there to be a change in the balance of conservation laws towards habitat protection. SSSIs should be truly inviolate not to be over-ruled by planning permissions but subject to compulsory (government-funded) management regimes. Land owners and farmers need to have real financial incentives to retain countryside features important to our wildlife. Never has it been more important for the government to introduce stronger legislation to protect wildlife habitats in the countryside.

References

BEEBEE, T. J. C. 1975 Changes in the staus of the great crested newt *Triturus cristatus* in the British Isles. *Brit. J. Herpetol.* **5**, 481-490.

BEEBEE, T. J. C. 1977 Habitats of British amphibians (1): chalk uplands. *Biol. Conserv.* **12**, 279-93.

BEEBEE, T. J. C. 1979 Habitats of British amphibians (2): suburban parks and gardens. *Biol. Conserv.* **15**, 241-57.

BEEBEE, T. J. C. 1981 Habitats of the British amphibians (4): agricultural lowlands and a general discussion of requirements. *Biol. Conserv.* **21**, 127-39.

BRITISH HERPETOLOGICAL SOCIETY (no date) *Surveying for amphibians — practical guide.* International Centre for Conservation Education.

BULL, A. L. 1988 Birds on the farm — a twenty-five year study. *Trans. Norfolk Norwich Nat. Soc.* **28**(1), 63-71.

BUCKLEY, J. 1975 Amphibia and reptile records from Norfolk. *Trans. Norfolk Norwich Nat. Soc.* **23**(3), 172-192.

COOKE, A. S. & FRAZER, J. F. D. 1976 Characteristics of newt breeding sites. *J.Zool.Lond.* **178**, 223-36.

COOKE, A. S. & FERGUSON, P. F. 1975 Is the palmate newt a montane species? *Brit. J. Herpetol.*. **5**, 460-3.

COOKE, A. S. & SCORGIE, H. R. A. 1983 *The status of the commoner amphibians and reptiles in Britain.* Peterborough: Nature Conservancy Council (Focus on Nature Conservation Series No. 3).

ELLIS, E. A. 1965 *The Broads.* London: Collins.
ELLIS, E. A. Is the palmate newt so rare in these parts? *Eastern Daily Press* 10 May 1958.
FRAZER, J. F. D. 1983 *Reptiles and Amphibians in Britain.* London: Collins.
HOLMES, R. M. 1952 Herpetology of the Holt District. *30th Report of Gresham School Natural History Society*, 10-11.
JONES, M. 1988 A survey of the reptilia and amphibia of Suffolk. *Trans. Suffolk Nat. Soc.* **24**, 9-24.
LUBBOCK, R. 1879 *Observations on the Fauna of Norfolk* (New Ed.). Norwich: Jarrold, 209-211.
MATHIAS, J. H. 1975 A survey of amphibians in Leicestershire gardens. *Trans. Leics. lit. phil. Soc.* **69**, 28-41.
ROBERTS, J. M. 1989 *Reproductive isolation in smooth and palmate newts.* Open University PhD. Thesis (unpublished).
SMITH, M. A. 1951 *British Amphibians and Reptiles.* London: Collins.
SOUTHWELL, T. 1871 Mammalia & Reptilia of Norfolk. *Zoologist* (2nd series) 2751-2760
STEWARD, J. W. 1969 *The tailed amphibians of Europe.* Newton Abbot: David and Charles.
TUXWORTH, B., CRANE, M. & MORRIS, P. 1985 *A report on the decline of Norfolk ponds for the British Herpetological Society.* (unpublished).

Acknowledgements
I am particularly grateful to those who have collected together records from other observers and forwarded them to me: notably J. G. Goldsmith (Norwich Castle Museum), R. E. Jones (Lynn Museum), N. Gibbons (Thetford Natural History Society) and M. Jones (Suffolk Naturalists Society). I am also most grateful to the following observers for sending in details of their sightings. Without their help this paper would not have been possible. Thanks are also due to Stephen Bolwell for the use of his photographs of the male great crested newt, crested newt larva and male palmate newt.

R. Andrews
J. Antram
C. N. Arnold
A. Baker
R. E. Baker
P. Banham
K. Beckett
G. Beckett
D. Billings
M. Blackburn
E. F. Boosey
W. J. A. Boyd
M. A. Brewster
R. S. Broke
D. W. Brown
A. Browne
A. L. Bull
K. Carmichael
R. Charles
P. R. Clarke
E. Cross
C. Cuthbert
L. Dearsley
R. J. Driscoll
K. C. Durrant
E. A. Ellis
L. Evans
R. Evans
F. Farrow
M. W. Ferguson
R. Foster
J. E. Gaffney
M. Gibbons
N. Gibbons
C. Gibson
H. B. Ginn
J. G. Goldsmith
S. Goldsmith
G. Goodwin
P. J. Gotham
T. G. Green
R. Hadman
M. R. Hall
P. J. Heath
R. Hobbs
T. Holzer
M. D. Hooper
R. J. Hornby
A. G. Irwin
H. Jenner
J. L. Jones
M. L. Jones
R. E. Jones
G. Keele
P. Keeler
G. I. Kelly
M. R. Kelly
J. Kemp
I. F. Keymer
S. G. Lake
P. W. Lambley
A. Langford
J. Larman
A. R. Leech
A. Leverett
B. Levey
J. Lunn
R. Maidstone
R. Malt
R. P. Martins
D. M. Maxey
J. Mayhew
R. M. C. Moore
G. Nobes
W. D. Partridge
P. Peak
C. P. Petch
R. A. Richardson
D. I. Richmond
R. M. Richmond
M. Rush
V. Sabberton
K. C. Saul
I. J. Simper
M. Sinclair
J. M. Sisley
S. South
R. Southwood
D. Stapleford
P. G. F. Steele
A. Stones
R. W. Thomas
M. Tollhurst
P. Tollhurst
F. D. M. Warn
G. E. White
I. White
A. C. Wilson
M. Woolner
J. Woolston
P. A. Wright
F. Wylam
B. Yates

THE RAFT SPIDER *DOLOMEDES FIMBRIATUS* – NEW TO NORFOLK

Lance and Stephanie Steward

8 Gayton Road, Grimston, King's Lynn, Norfolk.

The raft spider *Dolomedes fimbriatus* (Clerck) was first discovered at Roydon Common in January 1988 by Jonathan Hall during management work being undertaken by the West Norfolk Conservation Volunteers and the Norfolk Naturalists Trust. An adult or sub-adult spider was found together with a number of small spiders presumed to be young, when a tussock of rush was cleared from a well-vegetated pond close to the south-west corner of the reserve. It is thought that the spiders were disturbed from hibernation in the tussock. Subsequent searches by various people failed to relocate the spider.

As Honorary Wardens of the Common, we had been searching for the spider for some months when we finally found an adult, with a white-striped abdomen, early in June 1988. A second spider was photographed in the *Sphagnum*-filled ditch, which is a breeding locality for the dragonfly *Sympetrum danae* (Sulzer) and rich in other bog fauna. Another spider was found immediately afterwards walking rapidly through the heather a few yards from the ditch.

Between June and October 1988 we found a number of spiders at various places along the ditch, particularly in the area between the carr into which it drains and the point where the ditch forks (TF686219). Half-grown spiders were found in bog myrtle up to two feet above the water, whereas large specimens were discovered on the water, sometimes in the open, sometimes on wet *Sphagnum* (Fig. 1) and more frequently partly hidden at the base of the bog myrtle. If disturbed, those at the edge of the ditch would hide beneath the water. None of the spiders found in the summer had the white abdominal stripes or long, pale legs of the first, June specimens. A shed skin was found close to a set of dragonfly wings and another freshly-moulted spider was found on the water. Spiders were difficult to find in early summer. At any one time we found up to ten spiders of various sizes on the ditch and associated bog pools, but cursory searches found none elsewhere on the Common.

In October 1988 we secured a nearly full-grown male and female which we kept in separate tanks with water and bog myrtle. The female was kept in an outside shed and was inactive most of the time, resting with legs fore and aft on a ledge at the top of the tank. The male was kept indoors and fed on flies, mosquitoes and other spiders. He shed his skin and was taken to Norwich Castle Museum where Tony Irwin was able to confirm that the spider was *Dolomedes fimbriatus.*

The female was able to survive a sharp frost, beneath the ice in the tank. However, she was brought indoors and kept with the male for a month. Both spiders became quite tame when kept indoors, but when left alone in the shed they were more wary, sometimes going underwater when approached. The male once did this when we passed outside the shed window. We thought that this shy behaviour might account for some under-recording in the wild. In captivity, the male was photographed underwater and seen to use his silk in the same way as above water (Fig. 2). Both sexes maintained contact with the glass by means of the silk, which resulted in a gradual accumulation of threads around the top of the tank, where they spent most of the time.

The spiders spent a lot of time close together, but on one occasion the male was disturbed and fell onto the female, who swiftly attacked him. Whether as a result of this attack or merely from old age, the male died a few days later. The female

Trans. Norfolk Norwich Nat. Soc.
1989 **28**(3), 233-235.

Fig. 1 *Dolomedes fimbriatus* female, Roydon Common, June 1988.

Fig. 2 *Dolomedes fimbriatus* male under water.

was seen one afternoon to drink a vast quantity of water. Her abdomen swelled to about twice its usual volume and during the night she shed her skin. When given a mealworm she seemed to stun it immediately, but after an hour or so the mealworm recovered. The spider maintained her grasp with her fangs, repositioning the mealworm once, for two days, at the end of which she had sucked it dry.

In March 1989 the female was still in captivity, in the shed, being fed on flies from time to time. She became more active in that month, spending more time at the water's edge in the last week. Her legs were still rather shorter, stouter and darker than those of the adult photographed the previous June and her abdominal stripes were yellow. We therefore assumed that she had one more skin moult to undergo. However, a month previously she had spun a small tent, about one centimetre high, in the bog myrtle. We have so far been unable to find an adult male to replace the one lost in the winter but hope to find a mate and observe breeding behaviour which we have not yet seen in the wild. A thorough search over many days last summer failed to reveal any of the tents recorded in Bristowe (1958), and by P.R. Clarke from the *Dolomedes plantarius* (Clerck) site at Redgrave (Clarke, pers. comm.).

We can only speculate as to the origin of this apparently isolated population at Roydon, but *Dolomedes fimbriatus* was stated to be "common in the fens of Cambridgeshire" in Staveley (1866). Since the spider has gone unrecorded at Roydon despite a keen scientific interest in the site for at least thirty years, we consider it possible that a careful search of suitable habitat will reveal other colonies in West Norfolk.

References

BRISTOWE, W. S. 1959 *The World of Spiders*. London: Collins.
STAVELEY, E. F. 1866 *British Spiders*. London: Lovell Reeve.

PLANT NOTES FOR 1988 — It is perhaps unusual to start with the best records first, instead of building up to them slowly, but, to tell the truth, if new county records are the best then there is no cause for excitement! There are two new county records this year, both from the east of the county, and both alien aquatics which naturalise and spread quite rapidly so the Broads will soon be awash with least duckweed *Lemna minuscula* first found by Fred Rumsey with a party from Sheffield University led by Bryan Wheeler in July on the east side of Barton Broad. The second V.C. record followed within a month when Tim Rich came over from Monks Wood to do some Monitoring Scheme square-bashing at Woodbastwick.

Meanwhile, our own Ernest Daniels, foraging along the environs of the Yare at Whitlingham between the above two dates, discovered *Crassula helmsii* in a dyke. In the west of the county, another stalwart, Dorothy Maxey, discovered a second Norfolk site near her home at Shipdham, for the Dutch rush *Equisetum hyemale.* It is pleasing to record that rare arable weeds still continue to crop up at frequent intervals, widely scattered about the county. HW at Pentney found corn woundwort *Stachys arvensis,* dwarf spurge *Euphorbia exigua* and pointed leaved fluellen *Kickxia elatine* in one field, and later showed me another—a sugar beet field with a plant list of well over 70 species, including the shrubby plants in the hedgerow. More importantly though, two of the commoner weeds in that field were venus

looking glass *Legousia hybrida* and night flowering catchfly *Silene noctiflora.* GB reports small cornsalad *Valerianella dentata, Kickxia elatine* and the round prickly-headed poppy *Papaver hybridum* in the unsprayed margin of a barley field at Ringstead, while the long prickly-headed poppy *Papaver argemone* was found by her in a similar situation at South Creake. One last arable weed which has not featured in our records for some years is shepherd's needle *Scandix pecten-veneris* discovered in 1988 by SP at Woodton. I wonder if an area of newly disturbed and shingled over ground at the edge of a new churchyard at Lammas would count as an arable situation? RML records pepperwort *Lepidium campestre* as being abundant there.

From the transient, to the permanent—one would hope that they are permanent, now that the call for every acre possible to be drained has been dropped, Environmentally Sensitive Areas have been set up and the next best thing to a National Park created in Broadland. GB recorded bog pimpernel *Anagallis tenella* at a number of sites during the BSBI Monitoring scheme in West Norfolk, and ALB found some while being shown some interesting meadows at Yaxham. Deadly nightshade *Atropa belladonna* has long been known as a native plant of chalky woodland in damp situations, so perhaps Richard Tofts' discovery of it growing with an excellent chalk flora on the banks of the New Cut at Feltwell is not really surprising, bearing in mind, of course, that it is much less plentiful than it used to be. A party from Thetford out square-bashing at Ickburgh found hundreds of plants of tower mustard *Turritis glabra* another plant formerly quite widespread which I personally haven't seen for years. Perhaps the botanists in East Norfolk will have to join GB and her henchpersons in their efforts to plot a new county flora on a tetrad basis. She gives two examples from Petch & Swann (1968):- basil thyme *Acinos arvensis* "Common, dry places, equally on chalk and sand". She says that a year's recording in the west of the county almost confines it to the Breck with only six records in all. Catmint *Nepeta cataria* "Frequent on roadsides". The West Norfolk recorders have only found two colonies, one of which consisted of one plant. SP also records catmint at Holkham/Wells, 1987 and in TF6840.

Wood spurge *Euphorbia amygdaloides* is another declining plant, and it is encouraging to hear from RML that is is common on a roadside verge at Tunstead. The record has been passed on to the Research Committee.

Orchids always arouse interest as soon as they are mentioned, and a nice few records have come in this year. HW has hundreds of *Dactylorhiza* orchids at Pentney, and she also has some numbers of pyramidal orchids *Anacamptis pyramidalis.* RML also reports the latter, to the tune of over 450 on dunes to the east of Gun Hill, Overy Staithe, where he also found as many as 200 scattered bee orchids *Ophrys apifera.*

SP sends in site records of no fewer than eight species of orchid, which include both the aforementioned, including yet another site near south Norwich for the green-flowered helleborine *Epipactis phyllanthes.*

A plant, which reappeared in 1988 after being listed in the Flora of Norfolk as "extinct" is the common clubmoss *Lycopodium clavatum.* This was last seen in about 1903 in the Sheringham area. In 1988, David Mower again found it in the Sheringham area. One wonders if it had been there all the time! It would seem possible, as even the most frequently visited sites still turn up the unexpected. It is probable that some plants, being small and insignificant are just not seen. Take adder's tongue *Ophioglossum vulgatum* as an example. This is a plant of damp grassland bordering onto fen in the sites where I have seen it. SP records it from Woodbastwick,

though he didn't specify the habitat, HW & GB found it in alder carr at Pentney and GB also found it growing in reedbeds at How Hill!

Continuing thoughts on a new Flora—we in the east haven't made up our minds yet though we probably shall have by the time this appears—but GB would like all botanists visiting or living in West Norfolk to get in touch with her and send her plant lists. She has about 750 tetrads (so have we!), so, at this stage at least, the chances of duplicating anybody else's efforts are slim.

An alternative way of doing things might be to concentrate on sites rather than lines on a grid, which can, in the finished product be positively misleading. As an exaggerated example, recording in small squares such as a tetrad, it is possible for a ten acre field containing one unique plant, to be in four different tetrads—this would show as four squares on a map instead of one and make the plant appear much more frequent than it really is. At the same time, it is important to monitor changes in the plant life of this county much more intensively than has been done before.

What is happening for instance at Holt Lowes? Part of the area is kept open by walkers from the country park nearby, but how many of the choice species formerly found there have been squeezed out by shading from the over abundant silver birch? RML tells us that wood horsetail *Equisetum sylvaticum* is still abundant there. I wonder how many of the species can still be found, that are included in a list of the plants of Holt Lowes sent me by Tony Leech of Gresham's School, the list having been made by a predecessor of his, P. H. Simon, in 1952? Admittedly the list includes Lascelle's Wood and Lascelle's meadow, both of which are now coniferised and part of the Country Park. The list is approaching 350 in total and includes, for instance, the marsh St. John's wort *Hypericum elodes*, needle whin *Genista anglica*, lesser skull cap *Scutellaria minor*, grass of Parnassus *Parnassia palustris* sundews *Drosera* spp., wood cudweed *Gnaphalium sylvaticum* and no fewer than 15 species of orchid. Admittedly several of these were on the old racecourse (Lascelle's Meadow and Wood) and some at least still persist there, with the county's only colony of autumn ladies tresses *Spiranthes spiralis* numbering hundreds on one of the lawns at Gresham's School itself!

If we in the east do decide on a cohesive form of action, which would probably last until the year 2,000, we will let you know, so keep an eye on Natterjack for interim announcements.

Nomenclature in these notes follows Clapham, Tutin and Warburg (1985).

GB, Mrs G. Beckett; ALB, A.L. Bull; RML, R.M. Leaney; SP, S. Plant; HW, Mrs H. Williamson.

V.C. Recorders:- Mrs G. Beckett, Bramley Cottage , Stanhoe, Kings Lynn, PE31 8QF (West)

Alec Bull, Hillcrest, East Tuddenham, Dereham, NR20 3JJ (East)

References

CLAPHAM, A. R., TUTIN, T. G., & WARBURG, E. F. 1985 *Excursion Flora of the British Isles* Cambridge: CUP.

PETCH, C. P. & SWANN, E. L. 1968 *Flora of Norfolk.* Norwich: Jarrold.

A. L. BULL, Hillcrest, East Tuddenham, Dereham, NR20 3JJ

RECENT BRYOPHYTE RECORDS (1985-1988), INCLUDING FIVE SPECIES NEW TO NORFOLK

R. Stevenson

111 Wootton Road, King's Lynn.

Anomodon viticulosus (Hedw.) Hook. & Tayl. TF71 W. Acre, 1987 RS; TF81 Castle Acre Common, 1987 RS.
Barbilophozia floerkei (Web. & Mohr.) Loeske TF61 S. Wootton Common, 1986 RPL, new to Norfolk.
Barbula trifaria (Hedw.) Mitt. TF61 E. Winch, 1986 RS.
Bartramia pomiformis Hedw. TG03 Holt Country Park, 1986 RS.
Blasia pusilla L. TG13 Corpusty, MAB; TF61 W. Briggs, 1987 RS.
Brachythecium mildeanum (Schimp) Milde. TG30 Langley, 1988 DB, new to VC 27.
Bryum radiculosum Brid. TF71 Marham, 1986 RS.
Cryphaea heteromalla (Hedw.) Mohr. TF82 W. Raynham, 1986 RS.
Dicranum tauricum Sapehin. TF82 Helhoughton Common, 1988 RS, new to Norfolk.
Eucladium verticillatum (Brid.) Br. Eur. TF81 Castle Acre, 1986 RS.
Eurhynchium pumilum (Wils.) Schimp. TF61 King's Lynn, 1986 RS.
Fissidens exilis Hedw. TF82, S. Raynham, 1985 RS & RPL.
Fontinalis antipyretica var *gigantea* (Sull.) Sull. TF60 Stow Bardolph, 1986 CJL.
Fossombronia foveolata Lindb. TF62 Sugar Fen, 1988 RS, new to VC 28.
Jungermannia gracillima Sm. TF62 Roydon Common, 1988 RS, new to VC 28; TG13 Corpusty, 1986 MAB.
Leptobarbula berica (De Not.) Schimp. TF61 Corn Exchange King's Lynn, 1967 JGD, new to Norfolk. (This was originally recorded as *Gyroweisia tenuis*. Its true identity was discovered by RPL, and confirmed by HLKW).
Lophozia bicrenata (Schmid. ex Hoffm.) Dum. TG13 Corpusty, 1986 MAB.
Lophozia excisa (Dicks.) Dum. TF61 Bawsey, 1985 RS.
Orthotrichum pulchellum Brunton. TF82 S. Raynham, 1985 RS & RPL.
Pellia neesiana (Gott.) Limpr. TG03, Holt Lowes, 1986 MFVC, new to Norfolk.
Plagiothecium latebricola Br. Eur. TG31 S. Walsham Fen, 1987 RS.
Racomitrium elongatum Frisvoll. TL78 Weeting Heath, 1986 HLKW & MOH, new to Norfolk.
Rhynchostegiella tenella (Dicks.) Limpr. TF92 N. Elmham, 1986 RS; TF82 W. Rudham, 1987 RS.
Scapania irrigua (Nees) Nees. TF62, Sugar Fen, 1987 RS.
Tortula latifolia Hartm. TF50, Denver Sluice, 1987 RS.

DB D. Boyce; MAB M.A. Brewster; MFVC M. F. V. Corley; JGD J. G. Duckett; MOH M. O. Hill; CJL C. J. Lowe; RPL R. P. Libbey; RS R. Stevenson; HLKW H. L. K. Whitehouse.

RECENT MYRIAPOD RECORDS FROM NORFOLK

R.E. Jones

The Lynn Museum, Old Market Street, King's Lynn

Centipedes

A single specimen of the tiny species *Brachyschendyla dentata* Brolemann & Ribaut was collected from the soil of a disused chalk pit at Appleton in West Norfolk on 11 March 1989. The pit is used for the dumping of garden and other rubbish. This is the first vice-county record of this seldom collected species. It occurred in company with *Haplophilus subterraneus* (Shaw) and *Geophilus insculptus* Attems.

A second specimen of this same species was collected by the author and J. G. Goldsmith from the churchyard at Bixley (TG258049) on 16 March 1989. It occurred in company with *Geophilus electricus* (Linn.) and *Necrophleophagus flavus* (De Geer). The only previous records for Norfolk were from a garden in Norwich (Jones, 1986).

Millipedes

At the Appleton site mentioned above, and on the same date, *Nopoiulus kochii* (Gervais) was collected. This species, only recently proved to occur in Britain (Blower, 1985), has now been recorded from the Manchester area, South West Wales and Reading. This is the first county record. In appearence it resembles *Blaniulus guttulatus* (Fabricius), the common snake millipede with which it was found but the stink glands are somewhat darker red and it posesses an irregular row of ocelli which the latter lacks.

In 1988 a single female *Leptoiulus belgicus* (Latzel) was collected from the same pit (Jones, 1988). On this occasion two more females and a male were collected proving that this West Country species is established at this site. It was associated with large numbers of *Cylindroiulus britannicus* (Verhoeff) with which it was easily confused. The characteristic creamy-yellow dorsal line of *L. belgicus* is not prominent in the field and only becomes so after the specimen has been preserved in alcohol for a few hours.

Another record of note was the collecting of *Brachychaeteuma bradeae* (Brolemann & Brade-Birks) from Buckenham Tofts in the Stanford Training Area (TL894923) on 4 March 1989. A female *Brachychaeteuma* collected from Bixley on the above date was most probably also of this species.

All records are by the author unless otherwise stated.

References

BLOWER, J. G. 1985 Millipedes. *Synopses Br. Fauna (New Series)* **35**.
JONES, R. E. 1986 The centipedes of Norfolk *Trans. Norfolk Norwich Nat. Soc.* **27**(3), 221-226.
JONES, R. E. 1988 Recent records of invertebrates *Trans. Norfolk Norwich Nat. Soc.* **28**(1), 61-62.

SCORPION FLIES (MECOPTERA)

K.C. Durrant
18 The Avenue, Sheringham, NR26 8DG

Fig. 1 Mecoptera. Upper — *Panorpa communis* male.
Lower — *Boreus hyemalis* male. Scale line = 10mm

The scorpion flies are members of a very ancient order of insects whose remains have been discovered in fossil form from the Carboniferous period 250 million years ago. Only four species are to be found in Great Britain. They are all characterised by the very long head produced downwards to form a strong beak (Fraser, 1959).

Three species belong to the family Panorpidae, each of which have four very similar long spotted wings (Fig. 1) and are responsible for the vernacular name of scorpion flies because the males carry the terminal segment of the abdomen curved over their backs in a similar way to scorpions, but unlike them they are harmless. In fact they are scavengers and feed upon dead or injured insects and soft fruits such as blackberries, they are frequently found in nettle beds and bramble thickets.

All three species are fairly common, and in late July can often be found together in the same habitat. When disturbed they make a very short evasive flight to disappear behind the nearest cover. *Panorpa communis* L. is slightly larger than the other two and also exhibits slightly darker patterned wings, but as these patterns are very

Figs. 2-4 Genitalia of male *Panorpa*.
2 *P. communis* L. 3 *P. germanica* L. 4 *P. cognata* Ram.

variable within the species the only reliable identification aid is in the pattern of the appendages of the last abdominal segment of the males. (See Figs 2-4)

There is only one representative of the family Boreidae — *Boreus hyemalis* L. — a small wingless insect only 5 mm in length. In place of wings the female has a pair of small scales, whilst the male exhibits two pairs of bristle like vestiges but no turned up tail (Fig. 1). They have been given the name of snow fleas because of their habit of running and hopping over the snow covering their moss habitat in mid winter (Withycombe, 1922).

The first British record was made from Costessey by Dr W. E. Leach before 1826, (Edwards, 1901) but although they are fairly well distributed over the country they have not been rediscovered in Norfolk since that occasion.

References

EDWARDS, J. 1901 Insecta, Neuroptera. In *The Victoria History of the Counties of England, Norfolk.* **1**, 92-93 Westminster: Constable.
WITHYCOMBE, C. L. 1922 On the life history of *Boreus hyemalis* L. *Trans ent. Soc. Lond.* **1921**, 312-8.
FRASER, F. C. 1959 Mecoptera, Megaloptera and Neuroptera. *Handbk. Ident. Br. Insects* **1**(12 & 13).

AN ELUSIVE PIPUNCULID FLY TRAPPED IN NORWICH

S. V. Green

School of Biological Sciences, University of East Anglia, Norwich.

The Pipunculidae is a family of tiny flies, remarkable for having relatively huge compound eyes, and for their exquisite aerial prowess. *Nephrocerus flavicornis* (Zetterstedt), an unusually large pipunculid, is currently attracting interest amongst dipterists (Stubbs, 1989). At first glance it resembles one of the *Baccha* species of hoverfly, with a slender yellow-marked abdomen and large globular head, but its wing venation distinguishes this species as a pipunculid (Fig. 1).

During July 1988, a female *N. flavicornis* was taken in a water trap at the

Fig. 1 Female *Nephrocerus flavicornis*

Biological Sciences conservation area of the University of East Anglia, Norwich. This is the northern-most British record for this species (A. E. Stubbs, pers. comm.), and only the second to be taken in Norfolk, following a specimen taken by I.F.G. McLean in Wayland Wood in 1976.

The status and ecology of *N. flavicornis* remain uncertain. It has always been considered a rarity (Verrall, 1901; Colyer & Hammond, 1951; Coe, 1966), although its scarcity may be accentuated by a relatively short adult flight period (Laurence, 1952). Like all other pipunculids, *N. flavicornis* is presumed to be a parasitoid, the larva developing inside the body of a homopteran bug. The host's identity in this case is unknown. An association with oak woodland suggests a large oak-dwelling homopteran as host, such as *Ledra aurita* (Linn.), *Iassus lanio* (Linn.) or *Centrotus cornutus* (Linn.).

These three species are known historically from Norfolk (Edwards, 1878, 1884), but there are few recent records (A. G. Irwin, pers. comm.). Confirmation of the host will require rearing out the fly from a parasitized bug — not an easy task!

References

Coe, R. L. 1966, Diptera, Pipunculidae. *Handbk. Ident. Br. Insects.* **10**(2c).

Colyer, C. N. & Hammond, C. O. 1951 *Flies of the British Isles*. London: Warne.

Edwards, J. 1878 Fauna and flora of Norfolk. Hemiptera. *Trans. Norfolk Norwich Nat. Soc.* **2**, 490-500.

Edwards, J. 1884 Fauna and flora of Norfolk. Hemiptera. *Trans. Norfolk Norwich Nat. Soc.* **3**, 700-718.

Laurence, B. R. 1952 Records of Nephrocerus flavicornis Zett. *Entomologist's Rec. J. Var.* **64**, 28.

Stubbs, A. E. 1989 Pipunculids. *Diptera Recording Schemes Bulletin.* **27**, 8.

Verrall, G. H. 1901 *British Flies 8 (Platypezidae, Pipunculidae and Syrphidae).* Guildford: Taylor and Francis.

A PRELIMINARY SURVEY OF THE SUB-LITTORAL CHALK REEFS OF NORTH NORFOLK

C. L. J. Frid

School of Biological Sciences, University of East Anglia, Norwich

Introduction

The marine fauna of Norfolk is poorly described, most descriptions being of intertidal forms, supplemented by occasional records from fishermen and divers (Hamond, 1961,1963,1966). Most of the coast is composed of soft sediment environments, but at West Runton the mid and lower shore are composed of a wave cut chalk platform with overlying flint boulders. This chalk exposure extends offshore as a sub-littoral reef system. The region supports the famous 'Cromer crab' fishery. It also receives the output from a number of sewage outfalls.

In 1982 the south-eastern branch of the Underwater Conservation Society initiated a survey of the sub-tidal habitats of Sussex. This survey highlighted our poor knowledge of the ecology of marine chalk substrata. The initial survey was extended into a detailed survey of the chalk reefs of south-east Britain (Wood, 1984; Wood & Jones, 1986; C. Wood, unpub.), and the advent of the Channel Tunnel scheme made an assessment of the conservation value of these reefs imperative (Wood, 1989). Such an assessment could only be made if the national importance of the Sussex reefs was known. A survey of other chalk reefs was therefore initiated by the Nature Conservancy Council (e.g. Frid, 1987). The present study was designed as an initial survey of the Norfolk chalk reef system, to complement the data gathered by other surveys initiated by the Marine Conservation Society and the Nature Conservancy Council.

The reef system was surveyed by SCUBA divers, from the University of East Anglia Sub-Aqua Club. Observations were recorded on 'slates' in situ. Organisms were identified to the lowest taxon possible. A full species list is presented (Table 1) and median abundance values are calculated for the most commonly occurring species (Table 2).

Surveys were carried out at (i) Sheringham (52°57.2'N 1°12.6'E, TG150438) (31 July 1987), (ii) east of West Runton (52°57.0'N 1°14.3'E, TG180430) (16,17 August 1987) and (iii) west of West Runton (52°56.7'N 1°15.3'E, TG185430) (16 August 1987, 13 September 1987). All surveys were between 1.8 and 2.7 km offshore. Additional planned dives at East Runton and Cromer were aborted due to bad weather.

Results

The region surveyed is exposed in winter to the full force of gales approaching from within the arc subtended by the north-west and due east. Tidal currents, which tend to move parallel to the shore, reach 2.5 knots (1.25 m s^{-1}). The bottom varied from well defined chalk gullies, running approximately NW-SE, at the eastern sites to poorly defined gullies or a chalk platform at the more western sites. Throughout the survey area the bottom was littered with flint boulders ranging in size from 0.3 to 1.3m in diameter.

A wide range of species was recorded at all three sites (Table 1), the community being dominated by sessile filter feeders. The communities on the chalk platform

Present address: Field Studies Council Research Centre, Fort Popton, Angle, Pembroke, Dyfed

Trans. Norfolk Norwich Nat. Soc.
1989 **28**(3), 243-246

Table 1. Species recorded on the North Norfolk chalk reefs.

Algae: Rhodophyceae
Dilsea carnosa (Schmidel) Kuntze.
Lithophyllum incrustans Philippi.

Porifera
? *Haliclona oculata* Pallas.
Cliona celata Grant.
Halichondria panicea Pallas.
Hymeniacidon spp.
Myxilla spp.
Suberites domuncula Olivi.

Coelenterata: Actinaria
Actinia equina L.
Actinothoë sphyrodeta Gosse.
Metridium senile L.
Sagartia elegans Dalyell.
Sargartiogeton undata Müller.
Urticina felina L.

Hydrozoa
Eudendrium spp.
Nemertesia spp.
Tubularia indivisa L.

Annelida
Arenicola marina L.
Harmothoë impar Johnston.
Lanice conchilega Pallas.
Pomatoceros triqueter L.

Mollusca: Gastropoda
Gibbula cineraria L.
Archidoris pseudoargus Rapp.
Coryphella pedata Montagu.

Mollusca: Lamellibranchia
Zirfaea crispata L.

Arthropoda: Crustacea.
Balanus spp.
Cancer pagurus L.
Carcinus maenas L.
Eupagurus bernhardus L.
Galathea dispersa Bate.
Homarus gammarus L.
Hyas araneus L.
Macropodia spp.
Palaemon spp.

Bryozoa
Electra pilosa L.
Flustra foliacea L.

Echinodermata
Asterias rubens L.
Ophiothrix fragilis Abildgaard.

Chordata: Urochordata
Clavelina lepadiformis Müller.

Chordata: Vertebrata.
Blennius pholis L.
Pholis gunnelus L.
Pleuronectes platessa L.

and the top of the gulleys were comparable, while the sides and bottom of the gullies tended to be poorer in species. Even on calm days a considerable surge was felt in the gullies and this is probably responsible for the observed pattern. The lobster *Homarus gammarus* was associated with holes and crevices in the side of the gullies, as were large edible crabs, *Cancer pagurus*. Numerous small *Cancer* (less than 150 mm carapace width) were mobile over the chalk or under the flints.

The solitary hydroid *Tubularia indivisa* tended to occur as groups of about 6 individuals and was only found on the wave cut platform and the tops of the gullies. *Tubularia* colonies were occasionally overgrown by yellow sponge. This sponge, which resembled *Haliclona oculata*, was the dominant sessile form. The boring sponge, *Cliona celata*, was found boring into the chalk throughout the survey area. The boring bivalve *Zirfaea crispata* (the oval piddock) was only seen alive on the chalk platform to the west of West Runton although the remains of its shells were widespread. Plumose anemones, *Metridium senile*, were recorded at 7m, a single white individual ocurring on a flint boulder lying in the bottom of a gulley, while a number of clumps of the orange form were observed on the sides of a gulley. The sea slug *Archidoris pseudoargus* (sea lemon) was moderately common, up to 7 being

Table 2. Median abundance of the 9 most common species on North Norfolk chalk reefs.

Species	Median abundance	Comments
?Haliclona oculata	45% cover	Yellow form
Cliona celata	20% cover	Boring form
Lithophyllum incrustans	20% cover	
Halichondria panicea	10% cover	
Cancer pagurus	3.5 m^{-2}	Mainly juveniles
Asterias rubens	3 m^{-2}	
Eupagurus bernhardus	3 m^{-2}	Juveniles
Galathea spp.	3 m^{-2}	
Nemertesia spp.	1 m^{-2}	
Tubularia indivisia	0.25 colonies m^{-2}	avge 5 polyps/col.

encountered on a 15 minute dive, all the individuals seen were of the dark red/purple form (var. *flammea* Alder & Hancock).

The community showed a high degree of heterogeneity, and although some species, especially the sponges, were common locally there was always vacant space present. Macroalgae other than encrusting rhodophytes were rare in spite of the shallow depth (less than 6 m below Chart Datum). This was probably due to both low light penetration, because of turbidity, and scour by wave action.

Discussion

The communities observed on the chalk reefs of Norfolk seem similar to those described for Sussex (Wood, 1986), but are poorer in species. This could be the result of the less complete survey of the Norfolk reefs, or a reflection of their location. The isolation of the Norfolk reefs from possible sources of colonists may limit poor dispersers. The environmental differences between the English Channel and the North Sea may also limit species which reach the edge of their distribution on the south coast.

The composition and form of this community may be attributable to physical disturbance. The flint boulders which are common throughout the region would be moved by storm waves, causing abrasion of the organisms both growing on them and on the bedrock nearby. Scour by waterborne particles, especially within the gullies, and direct stresses imposed by the passing waves will introduce further patchiness into the community. It therefore seems likely that a considerable annual turnover of individuals occurs.

This study area represents the only major sub-littoral reef system in the county and its integrity should be safeguarded. The community resists severe, natural, physical disturbance annually. Disruption to small areas of the community are likely to be short term in their effects. The possible damage to the community from increased sediment loads produced by coastal construction projects would be lessened if such work were carried out in the autumn and winter. Stable hard substrata, such as pipelines and gas production platforms, will tend to accumulate a different fauna to the chalk reefs because of their greater physical stability.

Acknowledgements
This survey was supported by a grant from the Nature Conservancy Council. The efforts of the divers and boat-handlers of the University of East Anglia Sub-Aqua Club are gratefully acknowledged.

References
FRID, C.L.J. 1987. *The sub-littoral chalk reefs of North Norfolk: a preliminary survey.* Nature Conservancy Council. CSD Report No. 789, 16pp.
HAMOND, R. 1961 The marine fauna. In *Norwich and its regions.* Norwich: Jarrold & Sons.
HAMOND, R. 1963 A preliminary report on the marine fauna of the North Norfolk coast. *Trans. Norolk Norwich Nat. Soc.* **20**,2-31.
HAMOND, R. 1966 The polychaeta of the coast of Norfolk. *Cah. de biol. mar.* **7**,383-436.
WOOD, C. (ed.) 1984 *Sussex sublittoral survey.* South-east Branch, Marine Conservation Society.
WOOD, C. & JONES, E. 1986 *Seven Sisters marine surveys.* Ross-on-Wye: Marine Conservation Society.
WOOD, E. 1989 Subtidal communities on rocky substrata adjacent to the Channel Tunnel. *Prog. Underwater Sci.* **14**,79-93.

1988 WEATHER SUMMARY

N.W.K Brooks
79 The Street, Old Costessey, Norfolk.

January — A mild, mobile, 'westerly' month with frequent strong winds and moderate rainfalls, and only 7 dry days. Almost all of Norfolk had rainfall totals in excess of 100 mm. It was the wettest January since 1939, and in a few localities the wettest since 1922. A sudden snowfall on the 22nd covered the ground in places to a depth of 8 cm. The maximum temperature of 3.0°C on this date was the year's lowest.

February — The mildest since 1980 and the sunniest since 1949. Rainfall close to normal. Slight snow observed on 8 days.

March — In contrast to February, was very dull, the dullest since 1983. Rainfall was excessive, with only 5 dry days, and virtually the whole of Norfolk recording double the average monthly total. The fourth month in succession with a mean temperature above normal. The aurora borealis was observed on the evening of the 26th with rays of yellow-green, sometimes blue and pink light radiating to an elevation of about 60°.

April — A return to rather colder conditions with as many as 15 days experiencing winds between north and east. Rainfall distribution was very variable with much of west, north and central Norfolk notably dry, whilst eastern and south eastern areas were wet.

May — The warmest since 1976, (although in some parts of the county it was the warmest since 1970). The warmth was due more to sustained, rather warm days and nights, there being an absence of any really hot days, indeed 21°C was reached on only two days. No air frost was recorded. Rainfall was close to normal.

June — Although dry in much of Norfolk, it was a disappointing month with a marked deficit of sunshine, and only four days reaching a temperature of 21°C. With a preponderance of winds from the north east there were frequent dull, cool and misty days when the sun failed, even inland, to 'burn off' the North Sea stratus.

July — Very dull, wet, and cool, with almost the whole of Norfolk recording double the normal July rainfall total. (Scarning had the dubious honour of being the wettest locality, with a monthly total of 151.1 mm.) It was the wettest July in most of the county since 1946, and rain was recorded on as many as 24 days. 38.1 mm was recorded on the 21st. The highest temperature was a mere 23.1°C on the 1st. It was the coolest July since 1980. The temperature never fell below 17.1°C on the 22nd, the warmest night of the year. Thunder occurred on 9 days.

August — Temperatures were close to normal, with 16 days experiencing a maximum temperature above 21°C, and 4 exceeding a hot 25°C. The 18th with a maximum of 26.6°C was the hottest day of the year. It was a dry month, and would have been exceedingly dry had not the final day produced rainfall totals between 14-25 mm over most of Norfolk. The 31st was also thundery, and small tornadoes were reported seen from Watton, East Barsham, and Hunstanton.

September — A cool and dry month, although a small area of central Norfolk experienced heavy thundery rain on the 28th, with 32.3 mm recorded at Wymondham, and 40 mm at Besthorpe. Sunshine was rather below normal, and the first ground frost of autumn was recorded on the 30th.

October — A dry and quiet month with frequent morning fogs. A sudden electrical storm early in the evening of the 12th was quite dramatic, with some spectacular lightning, the most noteworthy of the year.

November — A generally anticyclonic month, the driest November since 1978, and much sunnier than usual, but cold, with as many as 14 air frosts and 21 ground frosts. Snow fell on 3 days and lay on one. The early morning of the 5th provided perhaps the most unusual feature, weatherwise, of the whole year. The screen minimum of -6.2°C, and the grass minimum of -8.3°C was the lowest temperature recorded throughout the year! It is likely that the year's minimum temperature being recorded in very early autumn happens perhaps once every 100 years.

December — Provided the seldom experienced combination of winter warmth *and* dryness. In some parts of Norfolk it was the driest December since 1933, with Snettisham recording a mere 12.2 mm. There was a total absence of cold weather, and by the month's end plants were responding to the onset of warmth after the cold of November. A sudden cloud clearance on the late evening of the 13th allowed a good view of the spectacular Geminid meteor shower, eight flaring meteors being observed during a ten minute period.

The Year — With a mean temperature of 9.8°C, 1988 was the warmest year since 1983. The very wet January, March, and July were nearly compensated by the dry autumn and early winter. Gales were notably infrequent, being recorded on only 3 days. Less sunshine than usual was experienced.

1988 WEATHER

	MEAN TEMPERATURE °C		NO. OF AIR AND GROUND FROSTS		SUNSHINE HOURS	
	1988	Avg.	1988	Avg.	1988	Avg.
Jan.	5.3	3.5	7/15	11/19	53.2	51.2
Feb.	4.7	3.2	9/23	12/18	115.7	66.8
March	6.0	5.3	7/15	7/17	93.5	100.6
April	7.9	7.3	7/11	4/14	136.2	154.2
May	12.1	10.9	0/4	1/6	196.7	193.5
June	13.9	14.0	0/1	rare	144.5	202.6
July	15.7	16.0	—	very rare	157.6	193.9
August	16.2	16.2	—	very rare	210.7	186.7
Sept.	13.6	13.9	0/1	rare/1	131.4	149.8
Oct.	10.5	10.4	4/6	1/6	99.4	109.1
Nov.	5.1	6.5	14/21	5/12	93.0	67.6
Dec.	6.3	4.2	3/14	9/17	55.1	50.5
Year	9.8	9.3	51/111	49/109	1487.0	1526.5

	RAINFALL mm		DAYS WITH SNOW/HAIL		DAYS WITH THUNDER	
	Costessey	Taverham				
	1988	Avg.	1988	Avg.	1988	Avg.
Jan.	113.1	58.4	2/0	5/1	0	rare
Feb.	42.9	45.0	8/3	4/1	1	rare
March	84.0	42.7	6/3	3/1	2	rare
April	41.6	39.9	1/0	1/1	0	1
May	40.5	41.7	0/1	rare	1	2
June	26.2	43.2	0/0	very rare/rare	0	3
July	146.4	57.9	0/0	—/rare	9	3
August	38.9	54.9	0/0	—/rare	1	3
Sept.	45.9	53.6	0/0	—/rare	2	2
Oct.	54.2	62.5	0/0	rare	2	1
Nov.	44.1	71.1	3/0	2/1	0	rare
Dec.	19.4	57.7	0/0	3/1	0	rare
Year	697.2	628.6	20/7	18/6	18	15

Averages quoted above are for 46 years to 1984 for rainfall, otherwise for 17 years to 1984.

NOTES FOR AUTHORS

The Transactions are published each year in the spring. Manuscripts should be with the editor by 1 December of the previous year.

Authors are requested to write to the editor for a copy of *Instructions for Authors* **before** writing a paper.

This issue of the *Transactions* may be used as a general guide to content and format, but it is advisable to consult the editor before preparing final text, figures etc. Failure to do this might result in delayed publication.

The editor will be pleased to discuss proposals for papers by any member, and will help novice authors with the production of material.

All communications, including manuscripts for publication should be sent to:
Dr A. G. Irwin, Castle Museum, Norwich, NR1 3JU.

NORFOLK & NORWICH NATURALISTS' SOCIETY

Patron: Her Majesty the Queen

The County's senior natural history society. It has for its principal objectives the practical study of natural science, the conservation of wild life, the publication of papers on natural history, especially those related to the county of Norfolk, arranging lectures and meetings and the promotion of active fieldwork. Specialist Groups cover most aspects of the county's flora and fauna.

Annual Subscription Rates:
Junior £3.00
Ordinary £6.00
Family £7.50
Affiliation £15.00

Publications:
May: Transactions
August: Bird & Mammal Report
Quarterly newsletter: 'Natterjack'

Secretary:
A. L. Bull
Hillcrest
East Tuddenham
Dereham
Norwich NR20 3JJ.

Membership Secretary:
C. Dack
12 Shipdham Road
Toftwood
Dereham
Norfolk NR19 1JJ

CONTENTS

		Page
Presidential address — Nature's curiosities	*R. E. Evans*	169
Fungal infection of algae in the Broads	*K. B. Clarke*	175
The lichen flora of Norfolk — systematic list	*P. W. Lambley*	183
The distribution and status of newts in Norfolk	*J. Buckley*	221
The raft spider *Dolomedes fimbriatus* — new to Norfolk	*L. & S. Steward*	233
Plant notes for 1988	*A. L. Bull*	235
Recent bryophyte records (1985-1988), including five species new to Norfolk	*R. Stevenson*	238
Recent myriapod records from Norfolk	*R. E. Jones*	239
Scorpion flies (Mecoptera)	*K. C. Durrant*	240
An elusive pipunculid fly trapped in Norwich	*S. V. Green*	241
A preliminary survey of the sub-littoral chalk reefs of North Norfolk	*C. L. J. Frid*	243
1988 Weather summary	*N. W. K. Brooks*	246

ISSN 0375 7226 *Printed by Witley Press Ltd., Hunstanton* £3.00

Norfolk Bird & Mammal Report 1988

Norfolk Bird Report — 1988

Editor: MICHAEL J. SEAGO
County Recorders: P. R. ALLARD, D. A. DORLING & P. D. KIRBY
Editorial Assistants: M. S. CAVANAGH, P. R. CLARKE, G. E. DUNMORE, M. FISZER, A. HALE, J. B. KEMP & A. M. STODDART

Editorial	249
Conservation of Stone Curlews	254
Yarmouth's Little Tern Colony	259
Birds of Estuary Enquiry	260
Wildfowl Counts	261
Predicting Autumn Highlights	262
Ringing Report	273
Classified Notes	279
Contributors, Photographers & Artists	314

Norfolk Mammal Report — 1988

Editor: REX HANCY

Editorial	315
The Common Seal Disaster	317
East Coast Seals	318
Norfolk Deer Parks	319
Contributors	322
Classified Notes	323

Published by THE NORFOLK & NORWICH NATURALISTS SOCIETY, Castle Museum, Norwich NR1 3JU (*Transactions* Volume 28 Part 4 August 1989) in conjunction with NORFOLK ORNITHOLOGISTS ASSOCIATION, Aslack Way, Holme-next-Sea, Hunstanton PE36 6LP. ISSN 0375 7226.
Back numbers are available from Mrs M. Dorling, 6 New Road, Hethersett NR9 3HH.

Price £3.00

NORFOLK BIRD REPORT 1988

BRITISH MUSEUM
(NATURAL HISTORY)
- 2 AUG 1989
EXCHANGED
GEN[illegible] LIBRARY

Editorial

The Council of the Norfolk & Norwich Naturalists Society, in conjunction with Norfolk Ornithologists Association, is pleased to present the annual report on the birds of Norfolk.

Review of the Year:

January was generally mild and wet and bird-watchers tended to concentrate on wildfowl. Co-ordinated counts included 18,800 Pink-footed Geese in north-west Norfolk. The Ouse Washes attracted nearly 3,800 Bewicks's and 505 Whooper Swans. The Cley area attracted one and sometimes 2 Black Brants and a Red-breasted Goose; these stayed until March.

February was the sunniest since 1949, but also wet with a colder spell at the month end. The RSPB new Reserve at Berney held up to 700 Bewick's Swans. Only new rarity of the month was an American Wigeon, accidentally shot at Holkham. Unseasonal surprises included Dotterel, Grey Phalarope and Turtle Dove.

March will best be remembered for the spectacular and unprecedented movement of Red Kites which commenced with an area of high pressure building-up over the country on 17th and an associated very mild airstream. This weather system was also undoubtedly responsible for a very early Alpine Swift at Brancaster Staithe. The month, however, was mainly wet and windy. Also notable was a major influx of Shags, especially inland in the west of the county.

April was again mixed with warm weather early in the month attracting several early migrants including Bonelli's Warbler. Latter part of April was typical of recent years with well below average temperatures inhibiting migration on the coast. A White Stork appeared at several locations on the first two days and Caspian Tern and Subalpine Warbler on the last two days. The month was largely characterised by such species as Black Redstart and Ring Ouzel, the latter being particularly widespread.

May — the mildest since 1970 — fortunately produced an abundance of easterly winds associated with high pressure over northern Europe. Blakeney Point was certainly the 'place to be' providing a Subalpine Warbler on 8th followed the next weekend and beyond with an obliging Bonelli's Warbler, a not-so-obliging Thrush Nightingale (giving most observers only flight views), 2 (possibly 3) Red-throated Pipits (including one in song), 3 Bluethroats, Ortolan and a splendid summer-plumaged Lapland Bunting. Early risers on 14th were rewarded by a Little Egret at Cley which soon moved westwards to be seen later at three other coastal localities. That particular weekend also marked the arrival of a Marsh Sandpiper at Snettisham. The newly created pools at Berney atttracted a succession of springtime surprises: American Wigeon, Green-winged Teal, Kentish Plover and up to 4 Temminck's Stints together. The month ended with the discovery of a Red-footed Falcon at Hickling which gave pleasure to many observers.

The following month was the driest since 1970, but not particularly warm with winds often from the east/north-east. Late passerines on Blakeney Point included Tawny Pipit and Icterine Warbler, together with Great Reed Warbler at Cley. Despite a long stay the bird was particularly difficult to see for much of the time. Odd rarities regularly appear during June and 1988 was no exception. Birders wishing to travel on the 18th/19th could not only have seen the above warbler, but also an unseasonal Surf Scoter at Holme, Terek Sandpiper at Holkham and 2 Caspian Terns at Hickling.

July was the wettest month since 1946 and the second wettest since 1925. Typically the month is associated with the commencement of autumn wader passage and undoubtedly the conditions were to their liking! Wisbech Sewage Farm was the great attraction in the past, but the tanks were finally reclaimed in 1985 depriving migrating waders of yet another 'staging post'. Fortunately raised water levels on Holkham fresh-marshes during the year have provided a new habitat producing also Buff-breasted Sandpiper, several Pectoral Sandpipers and Red-necked Phalarope at different times. In the Waveney Valley the 'discovery' of Gillingham flood-marsh — just within the county boundary — provided another new wetland locality; over 20 species of wader were recorded there during the year. The month also produced large movements of Manx Shearwaters. Only unusual passerine was a Woodchat at Waxham.

August weather was generally mixed, with heavy thunderstorms on the 31st. It was a disappointing month bird-wise with isolated sightings of Cattle Egret, one or 2 individual Bee-eaters, Lesser Crested Tern and a trapped Marsh Warbler. Fortunately a Purple Heron at Holkham and a White-winged Black Tern both lingered.

September was also unsettled, but gales resulted in excellent sea-watching spells including large movements of Gannets and Fulmars; also a notable number of Leach's Petrels and Sabines's Gulls. The Lesser Crested Tern was again seen early in the month, together with 4 Roseate Terns off Blakeney Point. The county also received its share of Long-tailed Skuas associated with an unprecedented national movement of this species. Among other highlights: Sociable Plover briefly at Titchwell and Holme, White-rumped Sandpiper at Cley (the only rare wader there during 1988), single Bee-eater sightings on consecutive days at a remarkable number of localities and an obliging Marsh Warbler adjacent to Cromer golf course.

During **October** many bird-watchers 'migrate' south-westward to the Scillies. However 1988 was undoubtedly one year when many wished they could have been in Norfolk instead, especially in the middle of the month. Possibly the month's potential could have been forecast on the opening day when a Short-toed Lark appeared on Blakeney Point with an Arctic Warbler at Yarmouth. Rainfall was above average, but a drier spell occurred towards the end. Interesting movements of grebes and owls added variety, together with a noticeable influx of Richard's Pipits. This species, together with Yellow-browed Warbler, have increasingly occurred in October in recent years and there was a major fall of the latter on 13th with at least 18 at Holkham Meals but with surprisingly few other migrants. An Olive-backed Pipit was discovered at Stiffkey. Two days later a high pressure area had become established over Scandinavia which resulted in the arrival of Radde's Warbler at Wells (East Hills) in a classic fall situation with easterly winds. Surprisingly no migrants whatsoever appeared on Blakeney Point. Yet next day similar weather conditions persisted and thousands of migrants were arriving throughout daylight particularly Thrushes, Robins, Goldcrests and Bramblings. Rarities included Pied Wheatear and Radde's Warbler. Rare passerines continued to arrive during the rest of the month: 2 more Radde's Warblers, 6 Pallas's Warblers, Isabelline Shrike and — from the opposite side of the globe — Indigo Bunting. A Whiskered Tern made a number of appearances at Welney. The end of October witnessed large numbers of coasting Little Auks (movements continuing until early December), together with the commencement of a major influx of Waxwings throughout the whole country, and the largest since 1965/6.

November was the driest for ten years, but ground frost was recorded on 23 nights. Normally early in the month can be interesting for both late passerines and for sea-watching, but 1988 was disappointing in this respect. No movements occurred until 18th/20th when several late Sooty Shearwaters put in an appearance. November saw the arrival of a Black-bellied Dipper at Lyng which must have been seen by several thousand observers during its lengthy stay.

December was the driest since 1933 and the sixth December in a row with above normal temperatures; in fact, no air frosts were recorded. As a result no cold-weather influxes from the continent took place. Bean Geese peaked at 350 in the Yare Valley and Wigeon reached a maximum of nearly 11,000 at Welney which also produced an American Wigeon — the only rarity of the month (GED).

Recording: The Editor and County Records Committee have undertaken a major review of the collation and assessment of records in view of the increasing numbers of bird-watchers generally and more particularly in the number of records submitted. It must be stressed that the increase in submitted records is welcomed as it has always been the policy of the Society that the *Norfolk Bird Report* is as comprehensive as possible. Even if records have to be summarised in the classified notes, they are all retained for future reference, both in their original form and on a card index system.

In order to ease the burden of recording an ever-increasing number of observers' submitted notes in the opening months of the year, regular and other contributors are requested to submit observations on a half-yearly basis. Despite regular requests for contributors to submit records by the end of January unfortunately many do not comply with this deadline. The reason for this timetable is to enable records to be entered on record-cards and also

in many instances for observations to be assessed by the County Records Committee. In future in order to meet printing deadlines work needs to commence on compilation of the classified notes at the beginning of April. It is hoped therefore that the end of January deadline for the submission of records, particularly for the second half of the previous year, is appreciated.

Records should be submitted to Michael J. Seago, 33 Acacia Road, Thorpe St. Andrew, Norwich NR7 0PP. All observations should be prepared in the order followed by The 'British Birds' List of Birds of the Western Palearctic. As all records are entered on cards species by species notes submitted in diary form cannot be considered in view of the disproportionate amount of time involved. In order to also help to minimise the work involved, records will not normally be aknowledged, but the names of all contributors will be included in the Report.

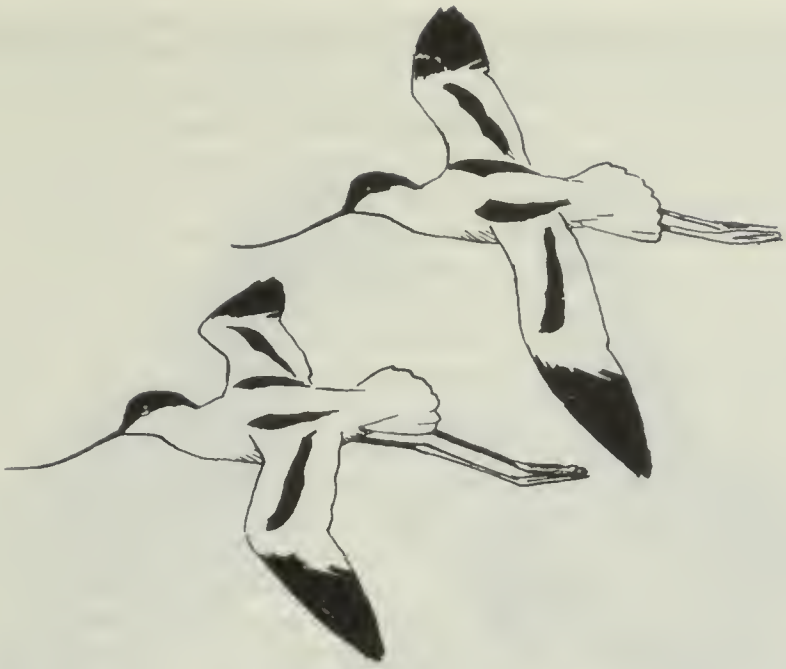
Records of national rarities considered by 'British Birds' Rarities Committee should be submitted with full details as soon as possible after observation and not left until the year-end. There are several omissions in the classified notes of national rarities as decisions are still awaited. Observers who find a national rarity are requested to submit details themselves rather than leaving the submission of such records to a small number of dedicated bird-watchers who are 'persuaded' to submit details if they have subsequently seen the particular bird rather than have it remain unconsidered and unrecorded. Record forms for the submission of such national rarities are available from the Editor and from G.E. Dunmore, 49 The Avenues, Norwich NR2 3QR.

The County Records Committee (Giles Dunmore, Steve Gantlett, Steve Joyner, John Kemp and Richard Millington) have reconsidered the semi-rare birds list last published in 1983. The following is the list of species and sub-species records of which in future will be considered by them: Black-throated and Great Northern Divers; Red-necked, Slavonian and Black-necked Grebes; Cory's, Sooty and Balearic Shearwaters; Storm and Leach's Petrels; Purple Heron, White Stork, Ferruginous Duck, Honey Buzzard, Red Kite, Montagu's Harrier, Goshawk, Buzzard and Rough-legged Buzzard; Peregrine, Spotted Crake, Corncrake, Kentish Plover, Buff-breasted Sandpiper, Red-necked and Grey Phalaropes; Pomarine and Long-tailed Skuas; Sabine's and Iceland Gulls; Roseate Tern, Black Guillemot, Little Auk, Puffin, Hoopoe; Richard's, Tawny and Water Pipits; all continental races of 'flava' Wagtail (excluding Blue-headed); Bluethroat; Savi's, Icterine and Barred Warblers; Red-breasted Flycatcher, Golden Oriole, Raven, Serin, Scarlet Rosefinch and Ortolan Bunting.

Field descriptions will not of course be needed for records of semi-rarities seen by many observers, but requests for descriptions will normally be made (if no such details are submitted with the record) where birds are only seen by one or two observers. This will apply particularly to often misidentified species: Great Northern and Black-throated Divers, Goshawk, Long-tailed Skua and Sabine's Gull which species are responsible for the greater proportion of observations rejected by the Committee.

In order to obtain as complete a coverage as possible of the bird-watching year, records are extracted from the publications of Cley Bird Club, The Birds Information Service, Norfolk Ornithologists Association and Nar Valley Ornithologists Society. Records of semi-rarities appearing in such publications will *not* be published in the *Norfolk Bird Report* unless details including the name of the observer(s) have been submitted. All birders are therefore requested to submit their records of semi-rarities direct to the *Norfolk Bird Report*.

Acknowledgements: Thanks are due to the following artists and photographers: N. Arlott, B. Bland, D. Bryant, D. Cottridge, C. Donner, R. Farndon, P. Haddon, H. Hems, R. Jones, D. Kjaer, C. R. Knights, B. J. Madden, J. R. McCallum, R. Millington, R. Powley, M. Rains, M. S. Read, the late R. A. Richardson, A. Stoddart and R. Tidman.

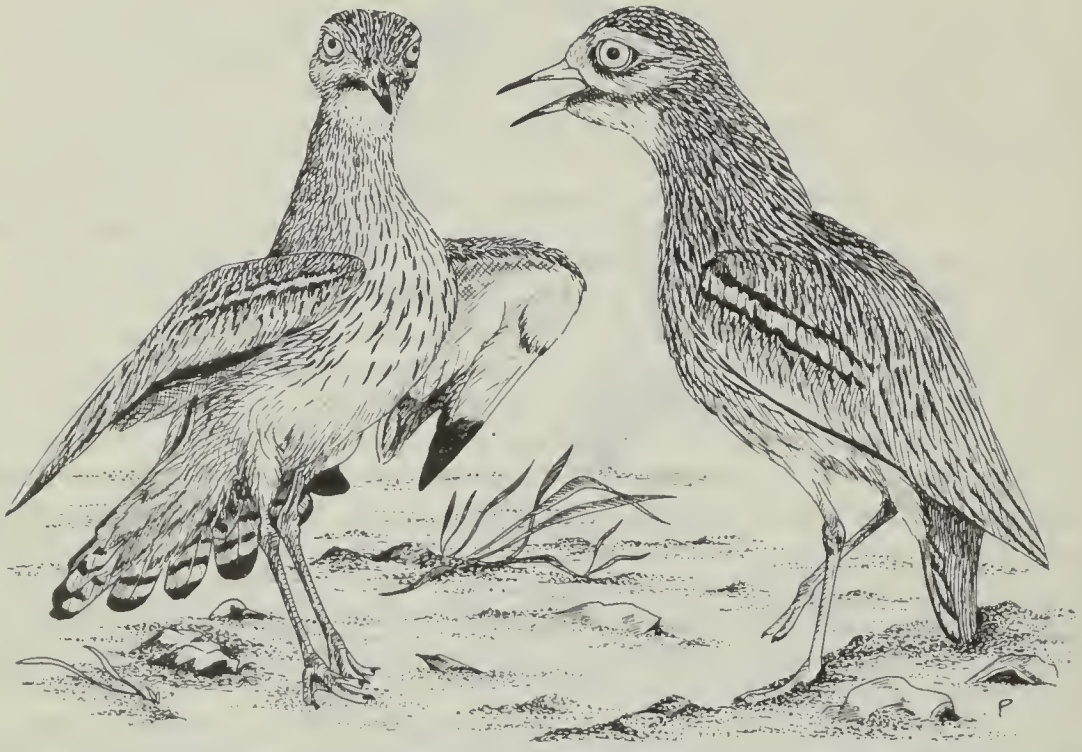


Thanks are also due to The Bird Information Service, Cley Bird Club, Norfolk Ornithologists Association, Norfolk Naturalists Trust, National Trust, Wildfowl and Wetlands Trust, Nature Conservancy Council, RSPB, Nar Valley Ornithological Society, G. E. Dunmore (for liaising with 'British Birds' Rarities Committee and acting as Secretary/Chairman of the local Records Committee), Mrs. M. Dorling, Mrs. S. F. Seago and all other contributors.

For the first occasion in fifteen years Dr. Moss Taylor's name is missing from the title page and it is greatly hoped the omission is only temporary. His considerable contribution through the years has been greatly appreciated.

Conservation of Stone Curlews

Dr. Rhys Green



The stone curlew is one of Norfolk's special birds and the only one to bear the county's name. Although the species occurs in several other English counties, its alternative name, the Norfolk plover, is more appropriate than the common name in some ways.

Stone curlews are found in Europe, North Africa, the Middle East, India and South-East Asia. Their distribution in Europe is contracting. Stone curlews have ceased to breed or have become very rare in the Netherlands, Germany, Poland, Czechoslovakia, Austria and Hungary during the 20th Century. The main populations in western Europe are in France, Spain and Portugal. Intensification of agricultural land use threatens the future of the stone curlew even in these strongholds where present status and trends in numbers are poorly known.

In the 19th Century stone curlews were found further north in Britain than they are today. They bred on the Yorkshire and Lincolnshire wolds and in the Cotswolds as well as in their 20th Century range in East Anglia, Wessex and the South Downs. They were, and continue to be, restricted to certain soil types. They are only found on sandy, well-drained soils strewn with flints or chalk rubble.

In the 1930s and 1940s stone curlews were still widespread on the large areas of heathland and dry grassland remaining in southern England and on tilled land in the same areas. The size of the population can only be guessed at, but there must have been at least a thousand pairs. A single autumn flock of over 600 individuals was counted in the Suffolk Brecks in the 1940s. Survey work undertaken for the British Trust for Ornithology's breeding bird Atlas in the early 1970s showed that stone curlews still bred in Dorset, Wiltshire, Hampshire, Berkshire, Sussex, Kent, Hertfordshire, Essex, Cambridgeshire, East Suffolk, the Norfolk and Suffolk Brecks and in north-west Norfolk. The population

Publication of this feature has been subsidised by a donation from Jarrolds of Norwich

was estimated at about 300 pairs. Recent information indicates a continued decline in population and a contraction in the species' range. Stone curlews are now either extinct or precariously rare in Dorset, Sussex, Kent, Hertfordshire and East Suffolk. Combining survey results from RSPB staff and birdwatchers during the period 1985-88 gives a current national population estimate of about 160 pairs. Of these about 90 pairs are found in Breckland, with about 35 pairs in the Norfolk part. The species still occurs in West Norfolk north of the Brecks, but its distribution is fragmented and poorly documented. It seems unlikely that the county total is more than 50 pairs.

The long-term decline in the numbers of stone curlews should alarm Norfolk ornithologists. The stone curlew population of Britain has been falling for decades and the available evidence suggests that the decline is continuing. Although the Breckland region of Norfolk and Suffolk continues to be the stronghold it is in danger even there. Action is required to stabilise and, if possible, to increase breeding populations throughout the birds' range in Britain. The RSPB is seeking to develop a strategy for conservation action to save the stone curlew. In this article I will attempt to describe the reasons for the bird's plight and the options available for those wishing to rescue it from extinction. If conservation measures for stone curlews are to be successful they must be based on detailed knowledge of the bird's requirements for feeding grounds and nesting places and the reasons for poor breeding success or survival. This article is largely based on an RSPB research project designed to fill some of the gaps in our understanding of stone curlew ecology.

Recoveries of stone curlews ringed in Britain show that they leave in October and travel through western France and north-eastern Spain to winter in southern Spain and North Africa. Only one ringed bird has been found in sub-Saharan West Africa, but the proportion of individuals travelling so far may be considerable because the chances of rings being recovered there is much lower than in Europe. The birds return to their breeding areas between mid-March and mid-April. There is no indication that birds breeding in different parts of England travel along different routes or have different wintering grounds.

Although stone curlews migrate in flocks and roost communally during the winter they seem to form pairs in March and April on the breeding territory. Frequently the members of a pair arrive at different times. By studying birds marked with colour rings we know that they tend to be faithful to the area in which they bred in previous years and to their mates if both members of the pair are still alive. On average about one in six adult stone curlews die in the course of a year.

Egg-laying begins in mid April. The nest is a scrape made by the male into which small stones and rabbit droppings are thrown by both birds. The usual clutch is two eggs. Short-grazed breckland heath grassland is the preferred nesting habitat. Stone curlews also nest on spring-tilled arable fields. Vegetated areas are avoided and, wherever possible, the birds select a patch of bare ground with many stones strewn on the surface. Even in April, autumn-sown field crops are too well grown to attract stone curlews. All spring-sown crops are short and sparse enough for stone curlews in mid-April when nesting begins, but spring-sown cereals, peas and field beans tend to become too tall and dense for them by mid May. Some nests in such crops are deserted when the plants become too tall and even if the eggs hatch the birds must move their chicks to more open areas. Crops such as sugar-beet, carrots and maize, which have a more open structure with much ground left bare, can be used for nesting and chick-rearing by stone curlews until late June or July.

Well-grazed breck grassland remains open enough for stone curlews throughout the summer. The persistence into midsummer of suitable conditions for nesting is important because their eggs take about 25 days to hatch and the chicks 50 days to fledge. If breeding failure occurs the birds can re-nest after 10-15 days. Hence if areas of sparsely vegetated ground are only present in spring there may be insufficient time for the birds to breed successfully.

Stone curlew chicks leave the nest soon after hatching but usually remain nearby until

they fledge. For the first two weeks of life most of their food is brought to them by their parents and the young birds remain concealed for most of the time. Even after the chicks begin to find prey for themselves the parent continue to provide much of their food.

Predators take a considerable proportion of eggs and chicks. Crows, hedgehogs, foxes and human egg collectors take stone curlew eggs. Foxes seem to be the main predators of chicks. Losses to predators tend to be more severe on semi-natural grassland than on tilled land, perhaps because there is more cover and alternative prey in these areas than on arable farmland. The laying of replacement clutches after failure occurs up until late July.

Stone curlews nesting on arable farmland are at risk from agricultural operations. Rolling of cereals and weed control cultivations in row crops can destroy eggs and kill or maim chicks. Spray irrigation can also cause birds to desert when the equipment is set up near a nest. The parent birds' superb camouflage and evasive behaviour is valuable protection against predators, but acts against them in this situation because it is difficult for farmers to locate nests and broods and avoid damaging them. Recently RSPB species protection wardens have been working in collaboration with farmers to improve the breeding success of stone curlews nesting on arable farmland. Nests are located and the eggs weighed and measured so that their stage of development can be determined. The farmer is advised of the location of the nest and the probable hatching date. Steps can then be taken to avoid the nest during any farming operations. It is more difficult to protect chicks than eggs because they move around the field. It is sometimes possible for the date of a farming operation to be brought forward so that it occurs before the eggs hatch. If this is not possible the chicks are carefully watched as the tractor works the field and temporarily picked up until the area has been worked.

By monitoring the breeding success of stone curlews nesting on arable land we have shown that the average annual production of fledged young per pair is improved by about 40% by nest and chick protection measures. Without protection the breeding success of stone curlews on arable land tended to be less good than for those on semi-natural grassland, but protection made birds in the two habitats equally successful. Our initial estimates of survival rates of colour-ringed birds indicated that this improvement in breeding success may be critical in reversing the downward trend of the stone curlew population.

Even if conservation measures are successful in producing more young stone curlews this will not increase the breeding population unless there is suitable breeding habitat available for them. The importance of sparsely vegetated ground for nesting has already been discussed. However, the birds also require areas in which they can feed. It is impossible to gain a proper impression of the feeding habits of the stone curlew by visual observation. The birds are wary of humans and tend to hide when an observer is visible to them. In any case most of the stone curlew's feeding takes place at night. We therefore studied the birds' diet by microscopic examination of faeces collected from their daytime roosts. It was possible to reconstruct the diet of wild stone curlews by counting prey remains in their faeces. Allowance was made for losses of some fragile remains during passage through the bird by using information gained from trials with a captive-bred stone curlew at London Zoo which was fed on known quantities of a wide range of potential prey.

It was found that the main foods of the stone curlew are earthworms, woodlice, millipedes and beetles. Occasionally small birds, mice, voles and shrews are taken. Most of these prey are common and widespread in many habitats, but studies of the foraging behaviour of stone curlews indicated that the birds can only hunt for them successfully in certain situations. We trapped adult stone curlews and clipped small radio-tags to their central tail feathers. The tags were less than 1% of the bird's weight and could be located from a distance of about a kilometre. They enabled us to track the birds throughout the day and night without disturbing them.

As anticipated, much of the birds' feeding activity took place during the hours of darkness.

During the incubation period the members of the pair took turns to feed while their partner covered the eggs. In most related birds one parent incubated throughout the night, but we found that stone curlews changed over at the nest by night much as they did during the day. This study also revealed that, although much time was spent feeding near the nest, the birds also visited scattered feeding places over two kilometres away. Birds fed further from the breeding territory before laying and during incubation than they did after the chicks had hatched. When the birds were feeding young, single food items were ferried to the chicks in the parent's bill, so long flights to and from distant feeding places would probably have been too demanding in time and energy.

Stone curlews are highly territorial around their nests, but certain feeding areas were used by birds from several different pairs. Favoured feeding habitats were short-grazed breck grassland, ley grass grazed by sheep or outdoor pigs and open areas of spring-tilled crops like those used for nesting. On arable fields the birds often fed near the field edge, probably taking invertebrates from the grassy margins. Heaps of manure, dumped in preparation for spreading on arable fields, also attracted stone curlews which fed on insect larvae living in them. Stone curlews probably detect their prey by sight. The prominent lemon-yellow irides of their huge owl-like eyes virtually disappear by night as their pupils open to gather as much light as possible. The birds' ability to see prey on the surface of the soil in dim light is probably critical for their foraging success and sparsely vegetated ground or a closely grazed sward is therefore required for hunting. Hence grazing by livestock and rabbits influences the feeding habitat of the stone curlew in two ways. Dung from these animals acts as food for some of the soil invertebrates that stone curlews eat and grazing keeps the vegetation short enough for the birds to be able to detect their prey.

This detailed information on the habitat requirements of stone curlews for nesting and feeding helps to explain why the birds are much more abundant in some areas with apparently suitable soils than in others. Short-grazed breck grassland is the preferred habitat because it remains suitable for nesting throughout the summer and because it holds large numbers of accessible prey. It also acts as a feeding ground for birds nesting on arable land nearby. On arable farmland away from breck grassland stone curlews occur at much lower population densities; at best one tenth of those on continuous areas of breck heath. The highest population densities on arable farmland occur where there is a high proportion of row crops like sugar beet and carrots, that act as nesting sites throughout the spring and early summer, mixed with ley pastures grazed by sheep or pigs. The presence of livestock is beneficial in providing the birds nesting on tilled fields with rich feeding grounds. Inclusion of grass in the crop rotation probably also increases the abundance of soil invertebrates when the fields are growing crops.

The stone curlew has declined for several reasons. Conversion of its best habitats, breck grassland and chalk downland, to arable farmland and commercial forests has resulted in substantial losses. In addition, many of the remaining areas of these habitats have become unsuitable for stone curlews because they are used less for grazing livestock than formerly and because their rabbit populations were decimated by myxomatosis and have not recovered. Most of these areas have been colonised by rank grass, gorse, scrub or self-set pine trees. Even the large expanse of breck grassland in the Stanford military training area is now almost entirely unsuitable for stone curlews because of undergrazing and lack of rabbits. As a result there has been a substantial decline in the proportion of stone curlews nesting on semi-natural grassland. At present only about one quarter of pairs nest in this prime habitat.

Stone curlews breeding on arable farmland have also declined because of changes in cropping and agricultural practice. In some areas stone curlews formerly nested in fields of spring-sown roots or kale grown as winter feed for livestock and they foraged on the ley grassland and permanent pasture on which the stock grazed in summer. Much smaller

areas of these crops are grown today and many farms in the south and east of England have specialised in growing cereal crops which do not provide good nesting or foraging habitat for stone curlews. Modern tractors and machinery carry out cultivations rapidly and provide less opportunity for chicks to escape being damaged by them.

What can be done to save the stone curlew from extinction as a breeding bird in Britain? Increased levels of grazing of breckland heaths and downland are required to recreate the stone curlew's prime habitat. The designation of Breckland by the Ministry of Agriculture as an Environmentally Sensitive Area has the potential to achieve this. Under this scheme farmers are receiving financial encouragement to graze heaths with sheep and cattle. More reserves grazed by enclosed populations of rabbits like that at Weeting Heath would also be of great value. In recent years rabbits have been intensively controlled throughout the Stanford military training area, even in parts that are remote from arable farmland where the rabbits pose a threat to crops. There may be a change in this practice which would help to regenerate suitable habitat in this former stronghold of the species in Norfolk.

At present most of Britain's stone curlews breed on arable farmland where they are vulnerable to changes in cropping patterns and farming practice. Increased growing of spring-sown row crops rather than cereals would increase the amount of farmland habitat for stone curlews as would an increase in the keeping of livestock on farms that were formerly entirely arable. The recently introduced set-aside scheme to reduce cereal surpluses by fallowing cropland could be used to provide new nesting areas for stone curlews, but the fallow land would need to be managed to reduce its vegetation cover if it was to be suitable for the bird. The management to produce such habitat is not permitted by present regulations, but as the scheme is still being refined they could be modified to aid this rare species. Long-term fallowing of the same piece of ground would increase the chances of the birds adopting such sites as traditional nesting places. However, stone curlews breeding on arable farmland are liable to poor breeding success unless their eggs and chicks are protected from damage during farming operations.

Habitat restoration measures to increase the proportion of the stone curlew population in semi-natural habitats seems to offer the best long-term prospects, but continued protection of the famland nesting birds to maintain their production of young is likely to be necessary for some time to come. The survival of a viable population of stone curlews in Norfolk, as elsewhere in Britain, will depend on strenuous efforts to restore and create habitat for them and maintain their breeding success. The stone curlew attracts much good will from the Ministry of Defence authorities and farmers as well as from bird conservationists. It will need all of its friends if it is to have a secure future as a breeding bird in Britain.

I am grateful to many farmers and landowners and to the Ministry of Defence for permission to work on their land and for their enthusiasm in helping stone curlews. My colleagues Michael Austin, Chris Bowden, Paul Holness, Mark O'Brien, Glen Tyler and Roger Taylor carried out much of the fieldwork on which this article is based. The work was aided by generous contributions from the Bexley, Lowestoft, Norwich and Vale of White Horse RSPB Members' Groups, H. J. Heinz 'Guardians of the Countryside' Programme via the World Wide Fund for Nature and the Nature Conservancy Council.

Great Yarmouth Little Tern Colony

1989 marks the Centenary of the foundation of the Royal Society for the Protection of Birds, an organisation which has taken an increasingly significant role in the field of conservation in recent years. We offer our congratulations on achieving this milestone and with them every success for the next hundred years.

We are fortunate in Norfolk that the RSPB owns or manages a number of important Bird reserves from Snettisham in the West, Titchwell on the North Coast, Strumpshaw, Rockland and Surlingham in the Yare Valley, to the new reserve on Berney Marshes at the head of Breydon.

A less well-known success story, which has national as well as local importance is a colony of Little Terns on Yarmouth North Beach. Despite being adjacent to a busy holiday camp a thriving breeding colony of these delightful summer visitors has developed over the last few years.

Peter Allard has summarised the numbers of Little Terns at Yarmouth, showing that from 1950 to 1983 a maximum of 9 pairs have bred, with none at all on 18 occasions. The situation changed during the 1983 and 1984 seasons when part of the north beach was fenced off while a sewer pipe was laid, permitting the terns to nest in the fenced area. The RSPB became involved in wardening the colony in 1986 when 55 pairs raised 95 young. By 1988, following improvements in both fencing and wardening, the colony has grown to 140 pairs raising 244 young.

In 1988 the first Little Terns were displaying on 1st May, with 9 birds present, building up to 50 by 14th May. Two days later fencing and notices were erected and wardening began with an information hut strategically placed on the higher dunes. The first eggs were laid 20th May with the first chicks hatching 12th June. By the month-end there were up to 280 adult birds within half-mile of the beach. The first chick flew 1st July and the last on 8th August. The fence was dismantled 13th August. Only one pair successfully reared young outside the enclosure, although one which nested only a metre inside managed to hatch young despite continued disturbance.

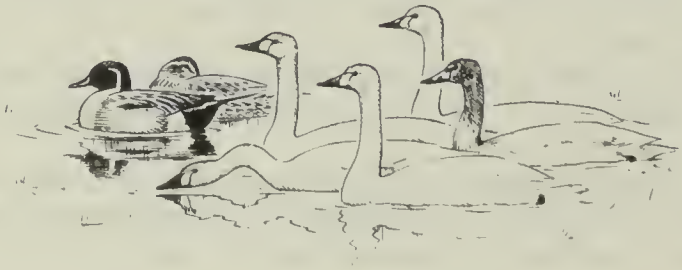
An interesting observation made 2nd July at the height of a hailstorm was when a large number of Little Terns took to the air and flew into the wind with heads thrown back and bills pointing upwards.

The colony represents 25% of the Norfolk breeding population of Little Terns, rearing 63% of known fledged young in the county, and 43% of those fledging in the whole of East Anglia.

Thanks are due to Peter Allard and the Yarmouth Group of RSPB, Mr & Mrs Street and other local RSPB workers for their efforts in achieving this success and for their permission to summarise the Warden's Annual Report as the basis of this note.

Birds of Estuaries Enquiry, 1988 Complete Wash Counts
(organised by BTO Estuaries programme staff)

	24 JAN	*21 FEB*	*20 MAR*	*17 APR*	*15 MAY*	*31 JUL*	*28 AUG*	*11 SEP*	*16 OCT*	*13 NOV*	*11 DEC*
Great Crested Grebe	19	66	19	52	3	26	42	49	96	61	37
Cormorant	148	198	152	80	33	96	132	294	218	206	281
Mute Swan	7	26	23	17	5	—	15	10	9	13	12
Bewick's Swan	70	106	20	—	—	—	—	—	—	4	—
Pink-footed Goose	2658	5029	910	—	—	—	—	—	60	562	6596
Brent Goose	22283	23166	12590	10207	7166	8	6	509	5908	16736	27612
Shelduck	16332	14176	8876	4380	1141	4213	3921	3805	10470	13928	9042
Wigeon	1429	773	555	2	3	1	15	123	1108	1765	2575
Gadwall	54	57	21	1	5	—	2	14	11	13	41
Teal	1117	399	361	1	—	—	322	639	306	498	269
Mallard	5448	5233	?	327	273	202	689	1442	2355	2759	2656
Pintail	6291	7715	369	—	—	—	124	86	1011	3149	4067
Pochard	34	43	24	—	—	3	14	5	70	74	42
Tufted Duck	32	38	15	18	14	18	22	21	47	37	49
Scaup	17	20	23	—	—	—	—	—	—	3	31
Eider	31	28	2	6	3	30	—	41	33	47	162
Long-tailed Duck	37	18	50	—	—	—	—	—	4	52	35
Common Scoter	327	85	89	16	—	—	16	—	—	1	6
Goldeneye	151	150	146	17	—	1	—	—	33	111	88
Red-b. Merganser	41	138	57	52	—	1	—	—	69	95	62
Oystercatcher	24966	35421	26919	6857	4006	16687	44371	29878	31122	45289	37287
Avocet	1	2	9	1	—	9	3	21	1	1	1
Ringed Plover	46	190	198	148	1217	689	2686	901	421	177	96
Golden Plover	1058	2124	2026	291	2	931	3218	4996	1063	2338	2257
Grey Plover	7170	8385	6955	7844	8662	588	8918	7215	9711	6644	4616
Lapwing	1484	5013	663	66	47	223	988	739	1119	2964	2755
Knot	72352	93666	41390	27970	654	38302	38925	39359	69701	75921	68112
Sanderling	572	477	236	345	253	1652	1024	664	310	298	222
Purple Sandpiper	19	28	—	—	—	—	1	—	—	1	21
Dunlin	29200	46239	43231	36198	21267	42120	21366	19994	39232	65679	35092
Snipe	23	162	56	6	4	14	67	12	31	36	25
Black-tailed Godwit	85	16	76	11	—	719	127	53	34	86	132
Bar-tailed Godwit	7988	10691	2105	151	726	4260	4787	5388	4402	8403	6662
Whimbrel	—	—	—	20	91	572	415	121	—	—	—
Curlew	1933	4814	4183	3242	630	6188	4967	4789	1894	3156	1593
Spotted Redshank	—	—	—	3	—	59	105	111	9	—	—
Greenshank	—	—	—	5	16	241	116	223	22	1	—
Turnstone	608	1995	973	975	342	2596	1850	1377	900	833	1050
Redshank	2661	7501	6434	3587	788	5641	9431	7526	4892	3460	2320



1987/88 Norfolk Wildfowl Counts

National wildfowl counts are organised by the Wildfowl Trust under contract to the Nature Conservancy Council. Swans, geese and ducks are covered, together with certain additional wetland species, at as many wetlands (coastal and inland) as possible from Sept to March. Up to 40 sites are covered in Norfolk: Antingham Pond, Blakeney harbour, Blickling Lake, Breydon Water, Cantley to Surlingham Marshes, Cley, Cockshoot, Fakenham to Gt. Ryburgh (Wensum Valley), Filby, Gunton Park, Hardley Flood, Heacham to Hunstanton, Heacham to Snettisham, Hickling, Holkham Lake, Holkham NNR, Holme, Horsey, Hoveton Little, How Hill, Martham, Mautby, Ormesby, Ouse Mouth, Ouse Washes (Welney), Pensthorpe, Pentney GP, Ranworth, Rollesby, St. Benet's Level, Salhouse, Scolt Head, Sea Mere, South Walsham, Stanford Training area, Terrington East, Thornham, University Broad, The Wash (East shore), Wells and Wroxham.

(*The Ouse Washes are administered as a single unit; although Welney is excluded for the 1987/88 winter it will feature in future*).

	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Sites Counted	26	30	30	32	35	36	32
Little Grebe	21	24	39	16	15	19	11
Great Crested Grebe	96	118	102	38	81	140	125
Cormorant	156	567	559	605	610	726	700
Mute Swan	226	318	334	310	292	404	322
Bewick's Swan	2	45	1108	680	1971	597	21
Whooper Swan	2	45	105	517	589	578	361
White-Fronted Goose	1	10	2	244	817	550	82
Greylag Goose	2500	1886	1450	2165	1957	1653	1598
Canada Goose	779	1148	464	728	952	666	544
Brent Goose	2	4583	9881	11123	10325	13413	3906
Shelduck	1194	2016	8268	9290	12149	10301	5773
Wigeon	1509	7157	12532	18521	20528	13120	9505
Gadwall	579	615	459	462	429	558	387
Teal	2625	2196	2587	2958	4008	3115	1947
Mallard	4943	7005	5843	9148	10452	8287	2827
Pintail	87	1092	1370	3978	5790	5526	261
Shoveler	386	416	531	403	606	624	427
Pochard	163	530	824	1420	1198	1489	806
Tufted Duck	289	337	493	699	1162	1151	946
Scaup	0	0	5	4	20	20	0
Eider	3	28	17	49	26	34	11
Long-Tailed Duck	0	0	4	0	37	18	50
Common Scoter	1	1	264	556	325	85	37
Goldeneye	0	5	104	177	240	264	157
Red-breasted Merganser	4	54	182	65	26	76	44
Coot	1100	1267	1395	2569	2267	1966	1335

Predicting Autumn Highlights on the North Norfolk Coast

S. C. Joyner

One of the highlights of any year, for the regular Norfolk birdwatcher is a visit to the north coast on the day of a large fall of continental migrants. Occasionally, these arrivals involve spectacular numbers of birds and there is always the exciting prospect of seeing one or more rarities. Most observers are aware that falls occur under particular weather conditions and they appreciate that an understanding of weather patterns can help them to predict the likelihood of a fall. Of course, there are weather patterns that indicate a large arrival is highly probable. However, moderate and small falls are less predictable. Forecasting these smaller movements and relating them to weather conditions presents the birdwatcher with a fascinating and challenging exercise. In this article I have attempted to review the factors influencing autumn migration across the North Sea and to illustrate some of the weather patterns favouring the arrival of continental passerine migrants on the north Norfolk coast.

Radar evidence (Lack 1960, Lack and Eastwood 1962) shows that autumn falls on the east coast mainly involve birds which have left the continent via southern Scandinavia. These birds can be divided broadly into two groups. The first are small night migrants, mainly warblers, flycatchers and chats (Whinchats and Wheatears), which have left their breeding grounds in northern and central Europe to migrate, via the Iberian peninsular, to wintering areas in Africa and the Mediterranean. This movement occurs mainly during late summer and early autumn, with a peak at the end of August and beginning of September. The second group consists of wintering passerines, (Thrushes, Goldcrests and Robins) which travel from Scandinavian breeding grounds during October and early November to winter in Britain and southern Europe. Both groups normally start their migratory flight from Scandinavia during the evening and given favourable conditions can fly the approximate 400 miles across the North Sea to arrive at the Norfolk coast the next morning; a journey time of about 14 hours for a Warbler flying in still air.

During October and November an additional movement of passerines occurs along the

Publication of this feature has been subsidised by a donation from Mr. Christopher Cadbury

North Norfolk coast. This is an east to west passage of winter visitors, typically Chaffinches, Starlings and Skylarks. These arrive in East Norfolk after the short sea crossing from the Low Countries and continue their westward flight parallel to the north Norfolk coast. As these east-west movements originate from central Europe they are not always associated with falls of Scandinavian migrants. This passage of wintering birds rarely results in large numbers landing on the north Norfolk coast. However, when conditions are favourable for migration across the whole of the North Sea these coasting movements may coincide with Scandinavian falls.

Autumn Migration across the North Sea

Before discussing the relationship between migrant arrivals and prevailing weather conditions, it is clearly helpful to have some understanding of the circumstances influencing the migration of birds across the North Sea. The size of migrant falls on the north Norfolk Coast will largely depend on three factors:

Firstly, the number of birds leaving the Continent on a given night. Secondly, the extent to which birds are drifted westwards across the North Sea towards the British Isles, and finally, the circumstances inducing migrants to land on reaching the coast.

Numbers of Migrants Departing

Autumn migration across the North Sea was extensively investigated by Lack (1960). His studies showed that continental night-migrants occur in eastern England primarily in settled weather associated with anticyclones centred over Scandinavia, which on their southern margin produce easterly winds in the North Sea. Moreover, he found that when easterly winds occurred with transitional or disturbed weather, (e.g. on the northern edge of a low pressure system centred just to the south of Scandinavia) the resulting arrivals were not as large, indicating that the number of birds leaving Scandinavia is related to the amount of cloud cover and the strength of the wind. The effect of cloud cover has been studied by Evans (1966). His radar observations indicated that departures of migrants take place almost as often under complete cloud cover as with partly clear skies, but that the total number of birds leaving in complete overcast is fewer.

Lack and Eastwood (1960-1962) found that the strength and direction of the wind does influence the number of migrants departing. They observed that movements occur primarily, though not exclusively, with a following wind within 45° of the heading of the birds, i.e. wind direction N.N.W. to E.N.E. for autumn migrants leaving Scandinavia. Accordingly, with west or south-westerly winds at night in the north-east North Sea arrivals rarely occur the following day — possibly because west and south-westerly winds produce warm nights not favourable for migrants departing. Strong winds in the north-east North Sea and Scandinavia appear not to favour large falls, migrants preferring to leave in light wind conditions.

Also, Lack found that large movements did not necessarily occur in the first fine day after a disturbed spell. This may be related to the ability of birds to detect changes in barometric pressure. Emlen (1975) has shown there is convincing evidence that birds about to initiate migratory flights are aware of the meteorological conditions, and accordingly may be able to predict a prolonged settled spell.

Wind direction in the North Sea

Radar evidence has confirmed that rather than avoiding the long sea crossing, migrants regularly leave Scandinavia on a broad front heading S.S.W. across the North Sea, and their final flight path is the resultant between their heading and the wind direction.

Analysis of the influence of wind direction shows that settled weather with easterly winds throughout the North Sea are the most favourable conditions for large arrivals, but these conditions did not automatically result in moderate or large falls. Factors, such as strength and direction of wind in the southern North Sea are found to influence the size of arrivals; strong cross winds, (i.e. E.S.E. and S.S.E.) causing extensive drift and favouring larger falls. Settled easterly conditions are predictably the most favourable for arrivals (Fig 6), but reasonable falls can occur under other circumstances. For example, moderate arrivals have been recorded with an easterly wind in the northern North Sea and light south-westerly winds in the southern North Sea. Also, of particular relevance for Norfolk with its north-facing coast, are the arrivals associated with a depression moving east across the North Sea during the night giving an easterly wind to the north and north-westerly winds behind it the next morning (Fig 3).

Studies (Lack 1960) on the effect of fog and complete overcast on birds during migration has not shown a strong correlation between foggy conditions and large arrivals. Moreover, radar tracking (Keeton 1979) has indicated that nocturnal migrants can orientate when the stars are not visible using alternative navigational mechanisms, such as the alignment of the magnetic vector of the earth's magnetic field.

Proportion of Migrants alighting at the Coast

The size of any fall will, of course, be a reflection of the number of birds which actually settle on reaching the coast rather than the number passing over and continuing inland. Radar monitoring (Lack 1960) has shown that with light easterly and north-easterly winds throughout the North Sea, night migrants regularly reach the Norfolk coast and continue inland without stopping. Conditions which encourage migrants to land include rain and adverse winds. Frontal rain has often been associated with the very large falls (e.g. September 1956, September 1965, and August 1987), but these spectacular falls are infrequent, primarily because settled anticyclonic conditions favouring large movements rarely concide with rain at the coast. Head winds probably lengthen journey times and may encourage an immediate landfall, but it is unclear if a higher proportion of birds arriving in the afternoon do, in fact, land on reaching the coast. Experience at Blakeney Point suggest that on occasions migrants continue to land well into the afternoon, but for moderate and small falls there are rarely significantly greater numbers of birds seen in the afternoon compared with mid-morning.

Large Falls

To illustrate the conditions suitable for a large fall, I have looked at the spectacular movements of September 1956 and 1965, and also August 1987. These demonstrate the classic situation of an anticyclone centred over or near Scandinavia and a low pressure system, with associated weather fronts, moving north into the southern North Sea (Fig 2a & 2b). Under these circumstances migrants leave the Continent in settled weather with clear skies and large numbers are drifted into the North Sea on strong easterly winds. As they continue south over the sea they fly into a belt of heavy rain which causes them to make the first possible landfall.

During the last two decades there have been very few large falls in September, mainly due to a persistent flow of Atlantic depressions becoming established across Britain. Frustratingly these depressions usually track to the north of East Anglia giving predominantly westerly or south-westerly winds over Norfolk throughout September.

Rare and Scarce Migrants

It has been known for a long time that falls of continental migrants often include a sprinkling of scarce or rare species. Indeed, this is one of the main reasons why falls are so eagerly

anticipated and keenly observed. The north Norfolk coast is accepted as one of the best areas in Britain for finding these rarer species.

Icterine Warbler, Wryneck, Red-breasted Flycatcher, Barred Warbler and Yellow-browed Warbler all occur regularly in small numbers. Icterine Warblers and Wrynecks are usually found in falls of Scandinavian migrants and occur in correspondingly suitable conditions (Fig 2). Similarly, Bluethroats, which normally migrate south-west during September, are seen in circumstances favouring larger falls. The current paucity of Bluethroats is probably linked to the lack of easterly conditions in recent Septembers.

By contrast, sightings of Barred Warblers, Red-Breasted Flycatchers and Yellow-browed Warblers are not always linked to arrivals of commoner Continental migrants. The normal autumn migration route for these species is away from the British Isles, either south-easterly or easterly. Clearly for these birds to occur in Britain a proportion of the population must migrate in a direction away from their normal standard orientation. These movements in the 'wrong' direction have attracted speculation concerning their cause and mechanism. The debate has centred primarily on two theories, a) random post-juvenile dispersal, and b) active reversed migration. The final explanation may well involve a combination of both.

Lack (1960) analysed autumn records of Barred Warbler and Red-breasted Flycatcher and found that arrivals not infrequently occurred on north-westerly winds and he suggested this was possibly due to post-juvenile dispersal. A further study by Nisbet (1962) linked the arrivals of Barred Warblers and Red-breasted Flycatchers to the prevailing weather conditions in their breeding areas in Germany. He found that arrivals were associated with high temperatures and light south-west and south-east winds on the western edge of central European anticyclones. Nisbet suggested that warm weather in central Europe induced juveniles to reverse their orientation from south-east to north-west. This reversed migration, with favourable southerly winds, overshoots the birds into areas north-west of their normal breeding range, i.e. Scandinavia and the North Sea. Juvenile Barred Warblers and Red-breasted Flycatchers finding themselves over the North Sea may then arrive on the British east coast in light wind conditions not necessarily favourable for arrivals of commoner Continental migrants (Fig 5). Barred Warblers and Red-breasted Flycatchers which arrive in Scandinavia on reversed migration may subsequently become caught up with movements of Scandinavian migrants.

Davis (1966) in his study of the great immigration of September 1965 found that falls of commoner migrants included many Barred Warblers and a few Red-breasted Flycatchers, despite the weather in Germany being most unsettled at the time. He suggested there had been an earlier dispersal or reversed migration bringing these species into Scandinavia prior to the main movement in September 1965. Nisbet (1962), similarly found that the distribution and timing of British records indicates that some Barred Warblers must resume movements in directions other than north-west or south-east after their pre-migratory flight.

Two Siberian species, Yellow-browed Warbler and Pallas's Warbler, regularly exhibit reversed movements in autumn and ringing has shown that the majority of birds involved are juveniles. A study of recent records by Harvey and Bell (1985) and Baker and Catley (1987) indicated that westward movements are associated with easterly winds on the southern edge of anticyclones centred over or near the breeding areas of these species. Baker and Catley have suggested that Yellow-browed Warblers initially in post-juvenile dispersal become drifted on the prevailing wind. The number of birds which occur in western Europe is then a reflection of the size and persistence of anticyclones over their breeding area and the strength of the associated easterly airstream.

It appears that one of the key features, in promising years for Siberian migrants is a large persistent area of high pressure centred over Siberia and Eastern Europe at the end

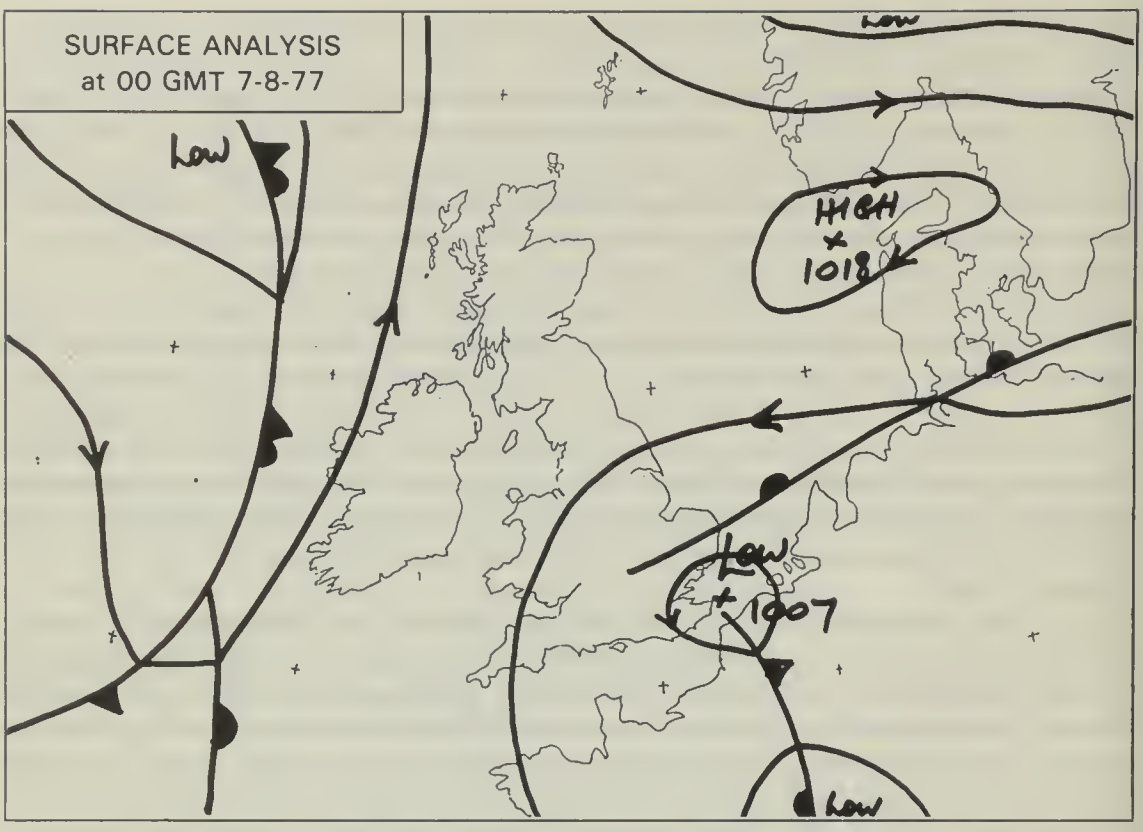
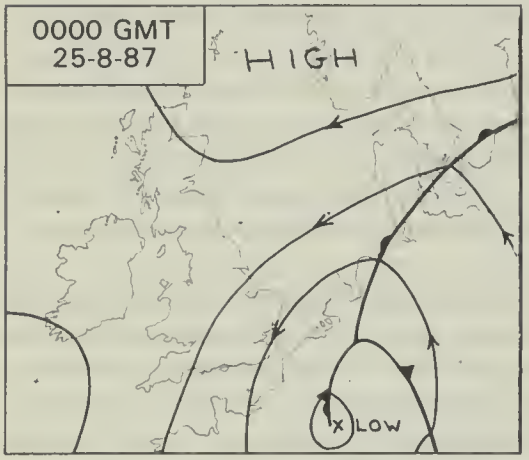


Fig 1. Chart for 7th August 1977. Not an ideal weather pattern with a high centred further south than normal, giving westerly winds over Norway and Sweden. However, with easterlies off Denmark and light north-easterly winds accompanied by rain over the Norfolk Coast there was a small arrival of commoner migrants (predominantly Willow Warblers), together with Wryneck and 8 Icterine Warblers. Fall conditions in early August can produce small numbers of the last-named.



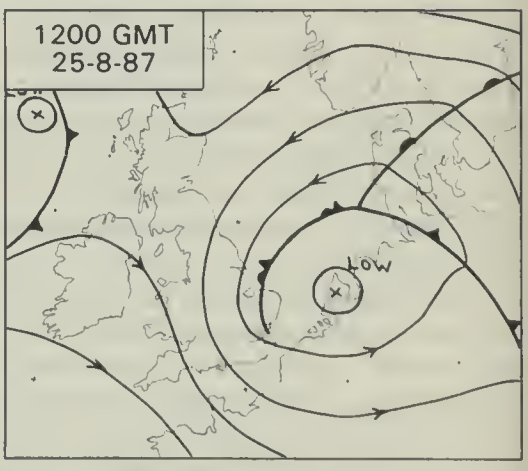


Fig 2(a) and 2(b). Charts for 25th August 1987 showing classic conditions for a spectacular fall with a large high over Scandinavia, strong N.E. winds in the North Sea and low cloud with rain reaching the north Norfolk Coast in the early morning. Species observed included several Wrynecks, 4 Icterine Warblers, Barred Warbler and 2 Grecnish Warblers. The second half of August is the best period for Grecnish Warblers, and falls accompanied by easterly winds along the southern Baltic region appear to be the most favourable. Before the recent decline in records, Aquatic Warblers occurred in similar circumstances.

of September and first half of October. The number of vagrants occurring in Britain then depends on favourable easterly winds becoming established across the North Sea. The distribution and timing of Pallas's Warbler and Yellow-browed Warbler records across Europe indicates a rather leisurely staged movement occupying several days. On the Norfolk coast Yellow-browed Warblers occur mainly at the end of September or early October, chiefly with arrivals of Continental migrants (e.g. Redstarts and Chiffchaffs), but occasionally they can arrive in westerly conditions unsuitable for commoner migrants. Pallas's Warblers usually occur later, from the second week of October onwards, normally in easterly conditions and often co-inciding with arrivals of Goldcrests.

Examples of Weather Patterns

In this section I have selected seven days to illustrate weather patterns associated with particular species. I trust they are representative examples demonstrating the diversity of conditions producing falls on the north Norfolk Coast. The maps show the weather pattern at 00.00 G.M.T. (except for Fig. 2b). Below each map follows a brief commentary giving details of wind direction and listing some of the birds observed on the north Norfolk Coast that day.

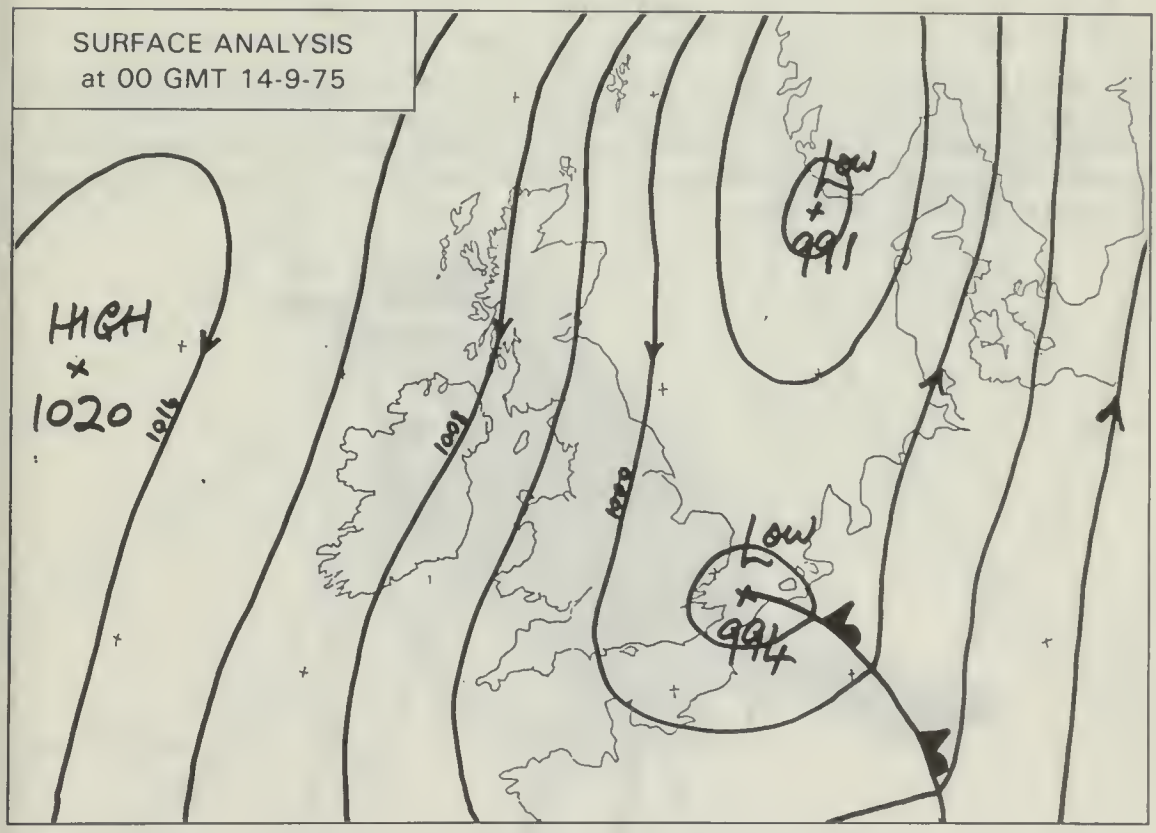


Fig 3. Chart for 14th September 1975 when a very disturbed pattern with a low crossing the southern North Sea giving overnight east winds off the Low Countries and northern Germany, followed the next morning by strong northerly winds down the North Sea. Good conditions for sea watching in mid-September but can result in small arrivals of migrants. At Blakeney Point 14th September, 1975 with a strong N.E. wind backing N.N.W. only a small number of migrants seen, but these included 2 Bluethroats, 2 Barred Warblers, 3 Red-breasted Flycatchers, Wryneck and Red-backed Shrike.

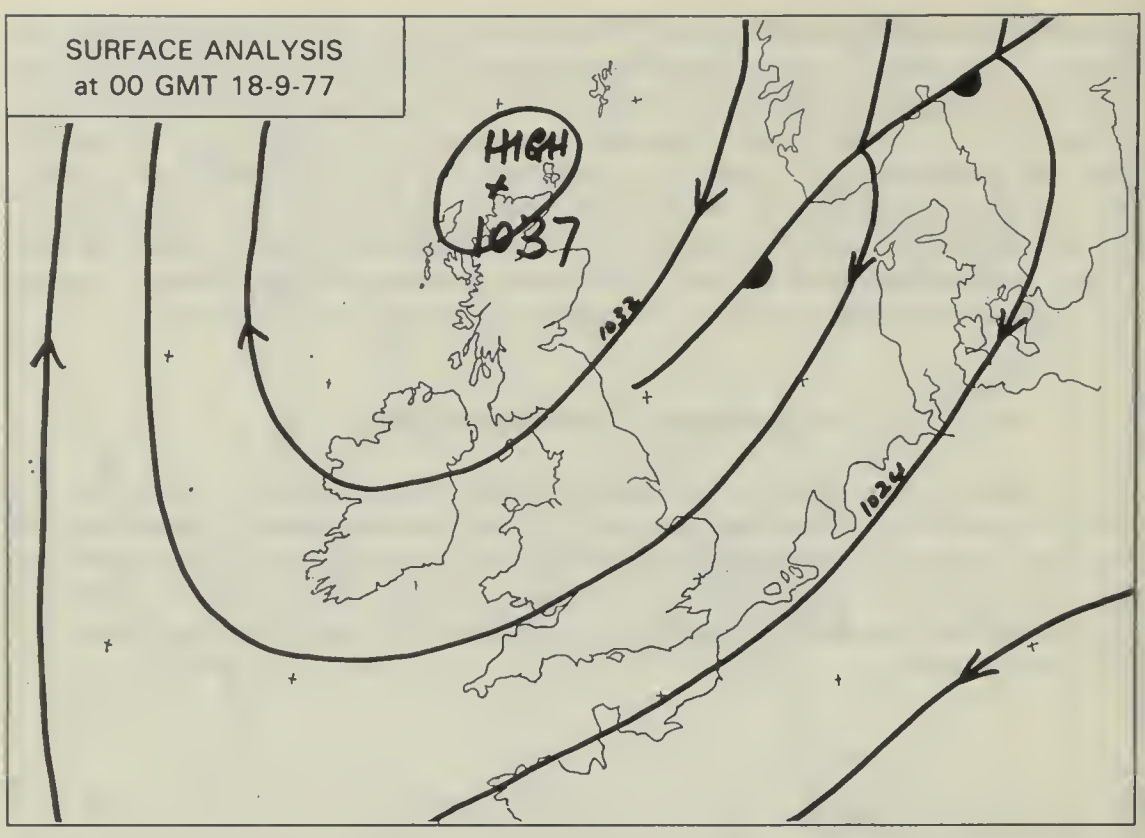
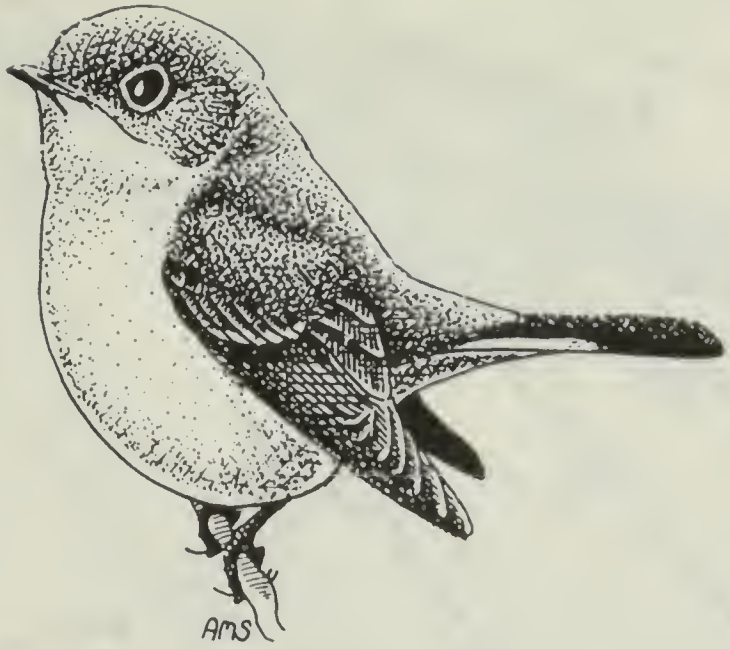


Fig 4. Chart for 18th September 1977. Regrettably an unusual situation in recent Septembers: a large high centred to the north of Britain giving N.E. winds down the whole of the North Sea.

On the 18th September, 1977 an Arctic Warbler was found at Holkham and given similar conditions in mid-September the traditional Fair Isle specialities, such as Yellow-breasted Bunting and Lanceolated Warbler, could well occur on the north Norfolk Coast.



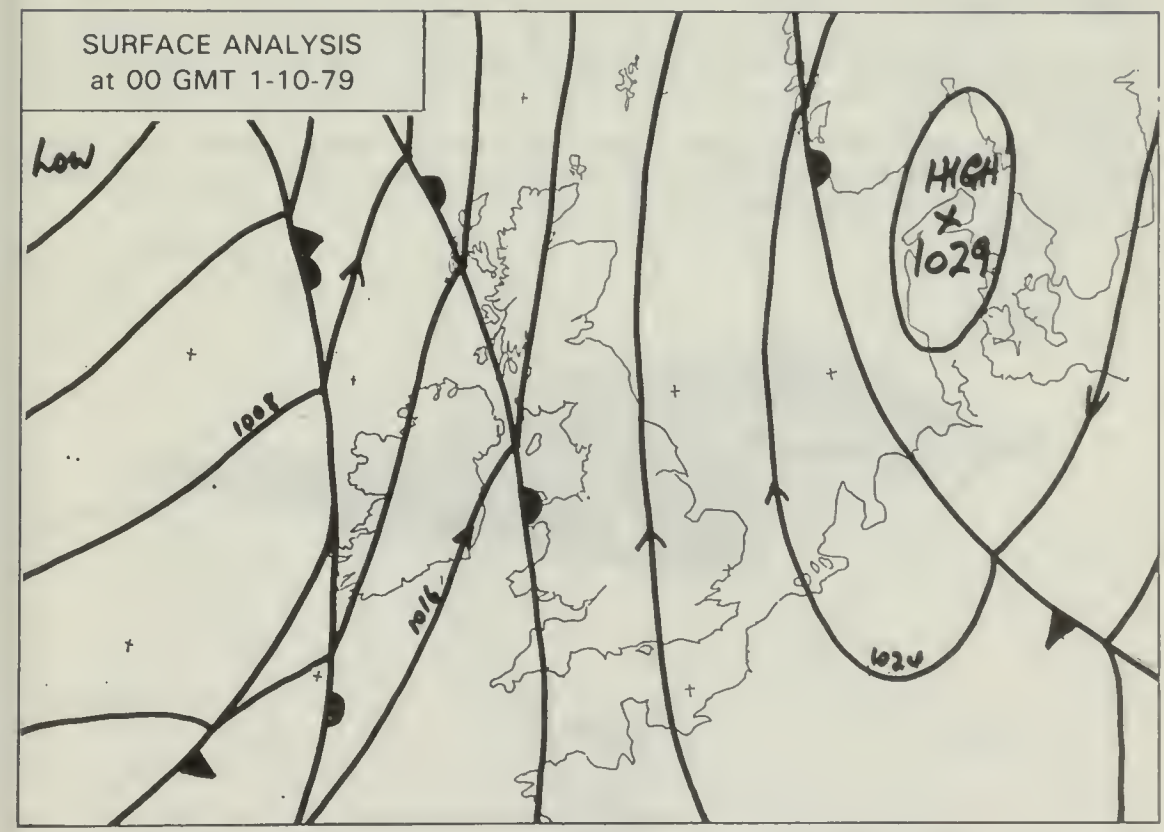


Fig 5. Chart for 1st October 1979 when light S.E. winds across the southern North Sea resulted in a good selection of migrants including 2 Red-breasted Flycatchers, 2 Yellow-browed Warblers and Icterine Warbler on the north Norfolk Coast. At the end of September and beginning of October settled weather over the Low Countries and Germany with light S.E. winds regularly brings Red-breasted Flycatchers and Yellow-browed Warblers — both species often arriving the same day.

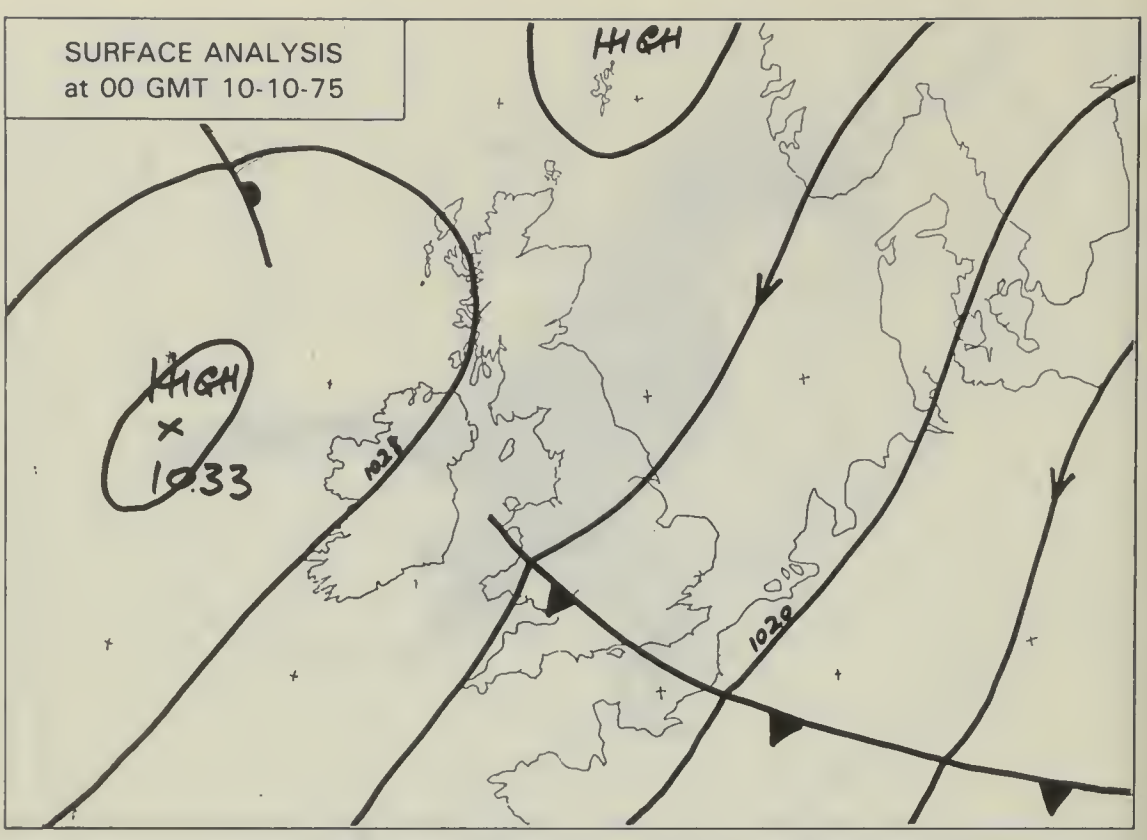
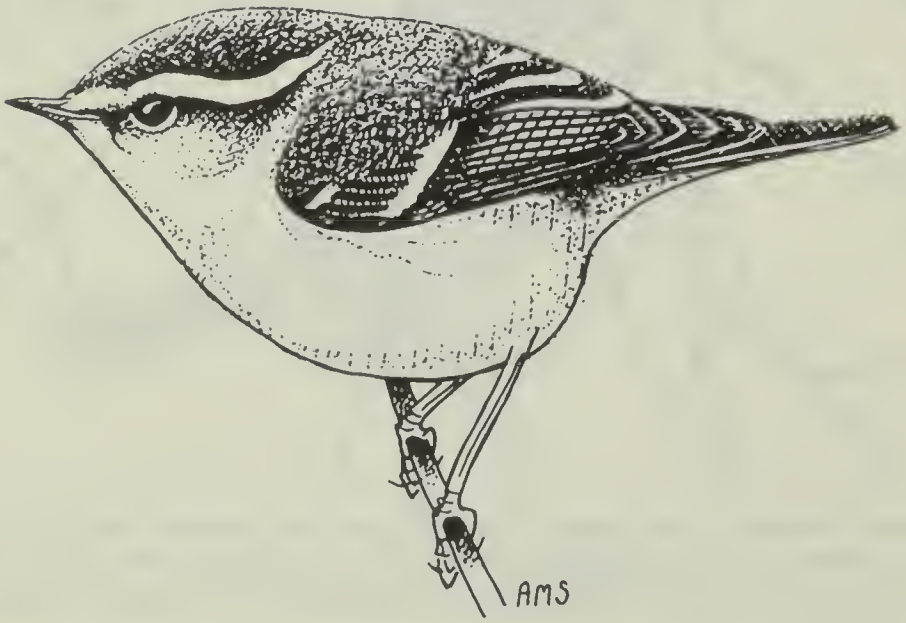
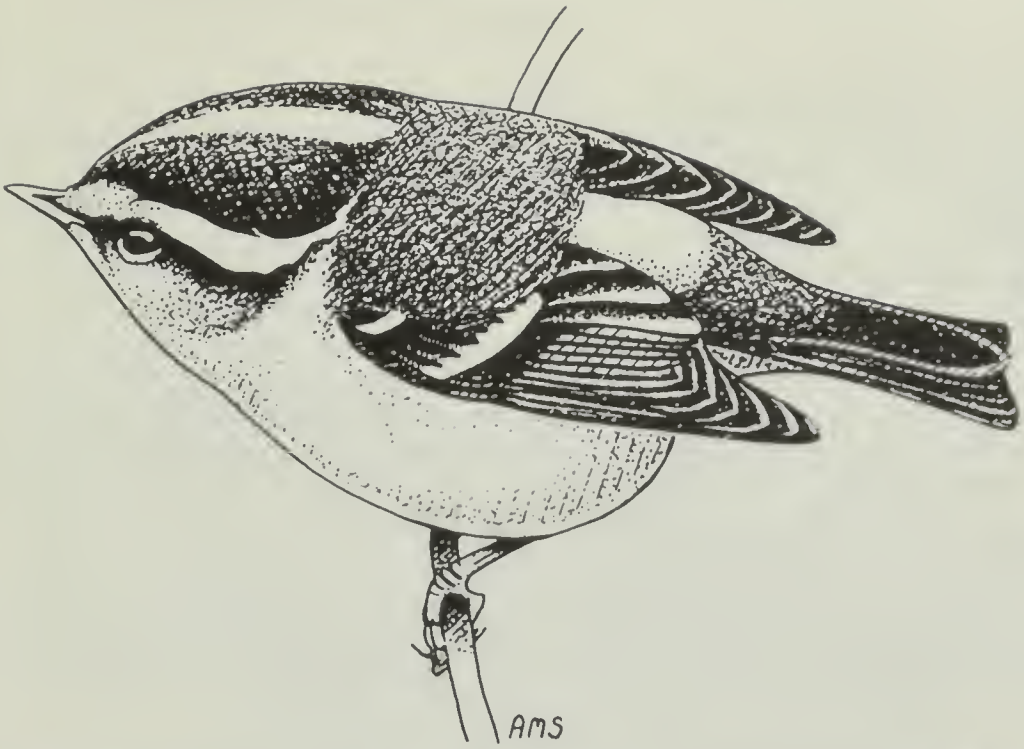


Fig 6. Chart for 10th October 1975 when perfect conditions produced one of the largest ever October arrivals on the north Norfolk Coast. The rarer species included Yellow-browed Warbler, Red-breasted Flycatcher and Olive-backed Pipit.

Easterly winds predominated for the remainder of the month and at times a continuous easterly airstream extended from central Siberia to Britain. In these ideal circumstances unprecedented numbers of Siberian vagrants were seen on the Norfolk coast during October 1975.





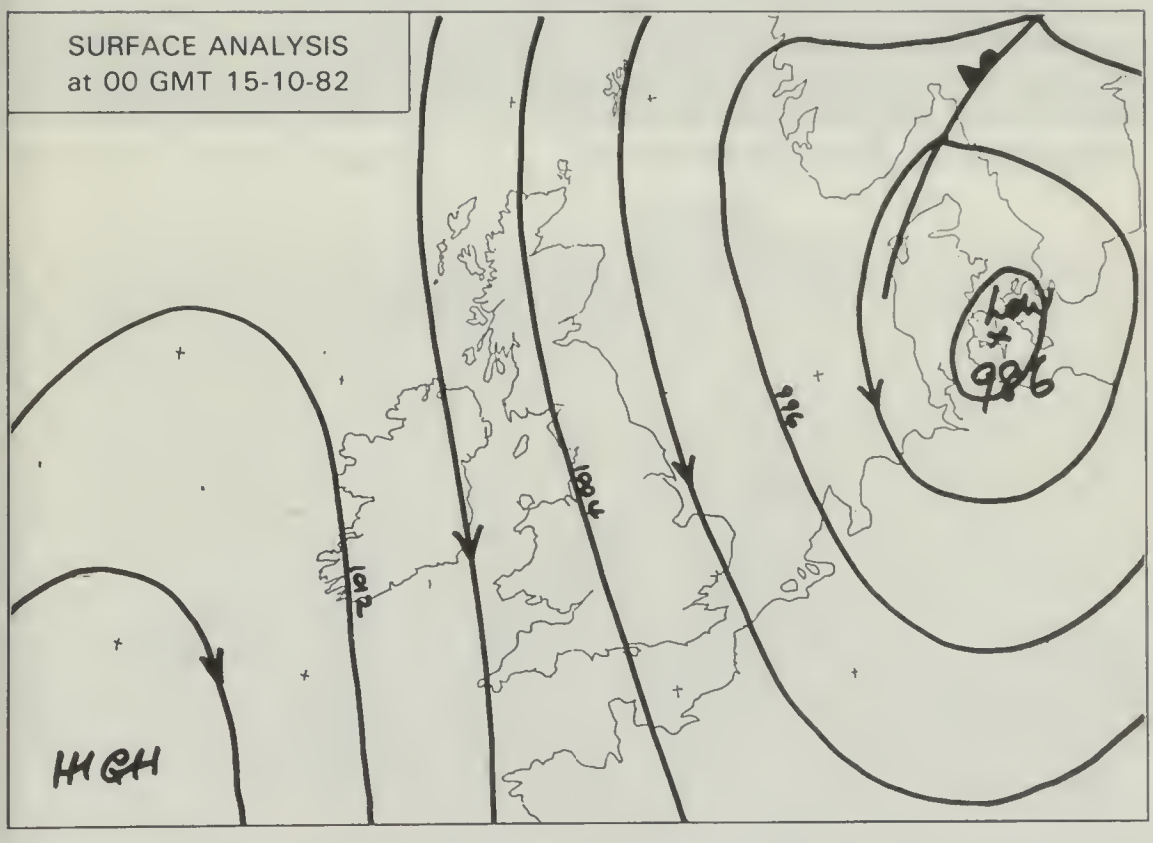


Fig 7. Chart for 15th October 1982. An example of an October fall in disturbed conditions, with a depression centred over Denmark giving easterly winds in the northern North Sea, circumstances which regularly initiate movements of wintering thrushes.

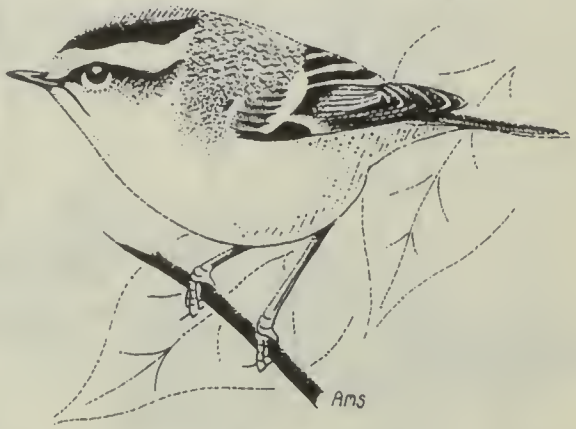
Interestingly the record 12 Pallas's Warblers found on the 15th October, 1982 arrived at the north Norfolk coast on light W.N.W. winds, having probably flown overnight from Scandinavia where they arrived some days earlier on a reversed movement. In early October 1982 record numbers of Pallas's Warblers were seen in Sweden and Finland.

Summary

Radar evidence has shown there is a regular autumn passage of night migrants from southern Scandinavia, heading S.S.W. across the North Sea. In light wind conditions the western flank of this movement passes over the Norfolk Coast. With adverse weather at the coast, such as rain, many of these birds settle rather than continuing inland. With easterly and south-easterly winds which occur with settled anticyclonic conditions, larger numbers of migrants leave Scandinavia and in addition to those crossing England on their normal S.S.W. heading, others that normally pass further east over the eastern North Sea or over the near Continent are drifted to eastern England. The stronger the easterly wind in the southern North Sea the higher the probability of a large fall. During periods of strong westerly winds throughout the North Sea large falls rarely occur, primarily because warm westerly and south-westerly winds are not conducive to migrants leaving Scandinavia.

A number of scarce and rare species are regularly seen in falls of Continental migrants. Some of these rarer species: Wryneck and Icterine Warbler, probably originate from breeding grounds around the Baltic region. Others, such as Barred Warbler, Red-breasted Flycatcher and Yellow-browed Warbler become involved in the main S.-S.W. movement of Fenno-Scandian migrants after an initial flight away from their normal autumn migration route. These reversed movements appear to be linked to southerly or easterly winds associated with anticyclones centred over their east European and Siberian breeding area.

Clearly the number of variable factors influencing migration across the North Sea ensures that it will never be possible to predict the precise occurence of every arrival of migrants. There will always be days when you visit the coast full of anticipation only to be disappointed. However on other occasions, with marginal conditions, you may be pleasantly surprised by an unexpected fall. But there is no doubt that studying weather maps does narrow the odds in your favour.



References

Baker, J. K. and Catley, G. P. (1987). Yellow-browed Warblers in Britain and Ireland, 1968-75. *British Birds*, **80:** 93-108. Davis, P. (1966). The Great Immigration of Early September,1965.*British Birds*, **59:** 353-375. Emlen, S. T. (1967). Migration: Orientation and Navigation. *In Farrer, D. S. and King, J. R. (editors) Avian Biology.* vol. 5, p.p. 129-219. New York. Evans, P. R. (1966). Migration and Orientation of Passerine Night Migrants in North-east England. *J. Zool., London.* **150:** 319-369. Evans, P. R. (1968). Reorientation of Passerine Night Migrants after displacement by the wind. *British Birds.* **61:** 281-301. Harvey, D. H. and Bell, M. (1985). Pallas's Warblers and Other Migrants in Britain and Ireland in October, 1982. *British Birds.* **78:** 381-391. Keeton, W. T. (1979). Avian Orientation and Navigation: A Brief Overview. *British Birds.* **72:** 451-467. Lack, D. (1960). Autumn 'Drift Migration' on The English East Coast. *British Birds.* **53:** 325-352 and 379-397. Lack, D. (1962). Radar Evidence on Migratory Orientation. *British Birds.* **55:** 139-156. Lack, D. and Eastwood, E. (1962). Radar Films of Migration over Eastern England. *British Birds.* **55:** 388-414. Nisbet, I. C. T. (1962). South-Eastern Rarities at Fair-Isle. *British Birds.* **55:** 74-85. Williamson , K. (1952). Migrational Drift in Britain in Autumn, 1951. *Scot. Nat.* **64:** 1-18. Williamson, K. (1955). Migrational Drift. *Act. Cong. Int. Orn.* **11:** 179-186. Williamson, K. (1959). The September Drift-Movements of 1956 and 1958. *British Birds.* **52:** 334-377.

Black Brants and a Red-breasted Goose provided dual attractions for wildfowl enthusiasts at Cley. Both rarities remained with the wintering Brent Geese until early March.

Waxwings descended on Norfolk from the last week in October. Ever delightful, these wanderers from northern taiga forests gave pleasure to a wide audience.

Large assemblies of Bewick's and Whooper Swans provide splendid winter scenes at Welney.

Shorelarks at Thornham Point, but will they return? At high water fearless Purple Sandpipers have become a regular feature at Walcott.

Newly arrived Fieldfares find sea buckthorn berries irresistible. Up to 25 ever-shy Hawfinches were regular visitors at Holkham Park during the opening months of the year.

Ringing Report

Allan Hale

During 1988 over 16,000 birds were ringed in Norfolk. There was a significant increase in the number of species handled from less than 100 in 1987 to over 120 in 1988. All of these figures are independent of the work done by the Wash Wader Ringing Group. Notable amongst the species were Hawfinch and Subalpine, Pallas's, Yellow-browed and Wood Warblers, reflecting the particularly good autumn passage experienced on the coast. Additionally, over 560 wildfowl were ringed at Pensthorpe, outstanding amongst these being 222 Tufted Duck.

Reports such as this naturally tend towards the unusual — the vagrants of the ornithological world. This year within the recoveries selected for publication are a selection of movements reflecting known migratory routes, reminding us that birds need not be off course for their journeys to be remarkable. It is however interesting to note that the recoveries include no less than 6 from Ireland. Whilst for a few species this may be expected, recoveries in Ireland for the passerine ringer are few and far between, especially during mild winters.

Thanks are extended to all Norfolk ringers from whose data this report has been extracted. Thanks also to Dr. N. Branson for the W.W.R.G. recoveries and their interpretation.

Readers are requested to refer to the 1987 Ringing Report for an explanation of all the abbreviations used in the recovery section.

NORFOLK RECOVERIES NOTIFIED IN 1988

Fulmar: Not only an interesting movement, but also within a year or so of the Fulmar longevity record.

1	6.8.63	Auskerry, Orkney
x	12.6.88	Sheringham 715km SSE

Shelduck: Note the age of this bird, found at the traditional German moulting area.

1	16.7.72	Cantley
x	30.9.88	Heide, Schleswig-Holstein, F.R. Germany 517km ENE

Wigeon: Pensthorpe continues to shed knowledge on Wigeon movements through Norfolk.

6F	11.3.86	Pensthorpe
x	26.12.86	Thurles, Tipperary 533km

5M	1.1.86	Pensthorpe
x	9.5.87	Kuusamo, Oulu, Finland 2,151km
6M	1.1.86	Pensthorpe
x	15.9.86	Altay, Kazakhstan, U.S.S.R. 4,203km
6F	2.2.86	Pensthorpe
x	18.12.87	Couderque, Nord France, France 228km

Gadwall: This represents a normal movement, over 130 British-ringed birds having been found in France.

3M	30.12.84	Pensthorpe
x	13.1.87	Lion-sur-Mer, Calvados, France 399km

Mallard: It is tempting to think of Mallard feeding on artificially supplied grain as being of local origin. Russian recoveries of this species are however not unusual.

3M	20.12.84	Welney
x	9.5.86	Loukhsky, Karelia, U.S.S.R. 2,367km NE

Pochard:

3M	24.9.83	Pensthorpe
x	23.10.86	Meza Rivermouth, Kostroma, U.S.S.R. 2,584km

Montagu's Harrier: The second British recovery (both concerning Norfolk) in as many years and, it would seem from the report, also not shot!

1	5.8.87	Norfolk
xL	23.9.87	Rocheserviere, Vendee, France 677km SSW

Hobby: This would suggest that the bird was of Continental origin and on passage when ringed.

5M	1.8.87	Hardley
x	7.5.88	Zaandam, Noord-Holland, Netherlands 223km E

Oystercatcher: These are examples of the very small proportion of Oystercatchers at the Wash which are not of Norwegian origin.

6	17.9.82	Thornham
x	12.8.88	Gufunes, Reykjavik, Iceland
8	26.8.80	Terrington
v	4.6.88	Toftir, Eysteroy, Faeroes
1	26.6.83	Fetlar, Shetland
xF	2.12.88	Snettisham 855km

Stone-Curlew: It is not just the passerines that suffer at the hands of the French hunting fraternity.

1	21.5.87	Bodney
x	25.10.87	Escorneboeuf, Gers, France 99km S

Ringed Plover: An old, but interesting recovery, only just received.

1	27.6.80	Hillington
x	2.11.80	Santa Cristina, Pontevedra, Spain 1,362km SSW

Knot: This represents the seventh Knot from the Wash to NE Canada. It must have been at least 19 years old when caught there.

4	7.3.70	Heacham
v	30.6.88	Esayoo Bay, Ellesmere Island, NW Territory, Canada

Curlew Sandpiper:

2F	19.9.85	Terrington
v	22.7.88	Ottenby, Oland, Sweden

Dunlin: The first two birds illustrate the considerable movement of winter Dunlin between estuaries. The latter two were juvenile birds ringed together and re-caught a month later, still together, at the Wash.

3	1.12.85	The Burrow, Portlane, Dublin, Eire
v	26.11.88	Snettisham
4	11.12.85	Rogerstown, Dublin, Eire
v	17.4.88	Terrington
v	15.8.88	Spieka, Oxstedter Bach, Luneburg, F.R. Germany
3	30.7.88	Cairnbulg, Banff & Buchan, Grampian, Scotland
v	28.8.88	Terrington
3	30.7.88	Cairnbulg, Banff & Bucham, Grampian, Scotland
v	28.8.88	Terrington

Bar-tailed Godwit: This represents the first British movement to, or from, Poland for this species.

4M	14.8.83	Reda Mouth, Gdansk, Poland
xF	23.3.87	Scolt Head 1,180km

Curlew:

4	12.8.87	Terrington
x	2.8.88	Arpet Charlie Gas Platform, North Sea
2	27.10.84	Wolferton
x	11.5.88	Jarventausta, Hollola, Hame, Finland

Greenshank:

4	22.8.82	Wolferton
v	10.8.88	Ribe Marsh, Julland, Denmark

Turnstone: This bird was presumably on spring passage to its breeding area in Greenland/NE Canada.

6	8.5.77	Heacham
x	15.5.88	Moskogar, Fljot, Skagafjardar, Iceland

Great Skua: Although a perfectly normal movement, this represents only the 4th recovery in Norfolk.

1	3.7.75	Hoy, Orkney
x	18.10.88	Walcott 730km SSE

Black-headed Gull: An interesting series of 6 juvenile dispersal records from Cantley demonstrating the expected westerly bias. Winter birds in Norfolk were recovered in, or from, Denmark (4), Federal Republic of Germany (3), Belgium (2), Sweden and Finland. Interestingly no less than three of these birds were over 12 years old.

1	22.6.86	Cantley
?	6.1.88	Manchester 272km WNW
1	24.5.87	Cantley
?	20.2.88	Gloucester 269km WSW
1	14.6.87	Cantley
?	24.1.88	Bodmin, Cornwall 488km WSW
1	6.6.88	Cantley
?	18.6.88	Beccles, Suffolk 14km SSE
1	6.6.88	Cantley
?	21.6.88	Eaton Socon, Cambridgeshire 128km WSW
1	6.6.88	Cantley
?	30.7.88	Solway Firth, Cumbria 405km NW

Common Gull: The recovery made no mention of whether the bird was in a breeding colony when the ring was read.

5	12.1.85	Norwich
vv	21.5.88	Copenhagen, Sjaelland, Denmark 808km ENE

Great Black-backed Gull: There are few recoveries of this species concerning Norfolk. This was a colour-ringed bird, and another marked on the same day was reported from Humberside at around the same date as the Weybourne bird.

8	6.12.87	Godmanchester, Huntingdon
vv	23.1.88	Weybourne

Common Tern: The first is a classic example of a bird in its second summer remaining in its wintering area off Western Africa. The second supports the theory that birds from inland sites return to inland sites to breed.

1	18.6.87	Hardley
x	30.6.88	Golf Tefess, Mbour, Senegal 4,549km SSW
1	22.6.85	Hardley
x	28.7.88	Buckhurst Hill, Essex 145km SW

Guillemot:

1	24.6.88	Ceann Ousdale, Helmsdale, Highland, Scotland
x	18.11.88	Bacton 667km SSE

Barn Owl: This species is much more sedentary than this recovery would suggest

1	15.5.87	North Norfolk
xF	23.7.87	Colne, Cambridgeshire 78km SW

Sand Martin: The northerly movement of the bird from Virginia Water to Cantley is atypical for an adult.

3J	16.7.88	Blackborough End
v	6.8.88	Icklesham, Sussex, 199km S
4M	4.7.87	Virginia Water, Surrey
v	19.8.87	Cantley 192km NE
4	12.7.87	Loddon
v	27.8.88	Isle of Grain, Kent 128km SSW

Swallow: Note the rapid movement of the birds to Landguard, clearly showing departure dates from the Norfolk roost.

2	16.9.87	Cantley
?	22.5.88	Guernsey, C.I. 445km SW
3	19.9.87	Cantley
v	20.9.87	Landguard, Suffolk 71km S
3	16.9.87	Cantley
v	17.9.87	Landguard, Suffolk 71km S

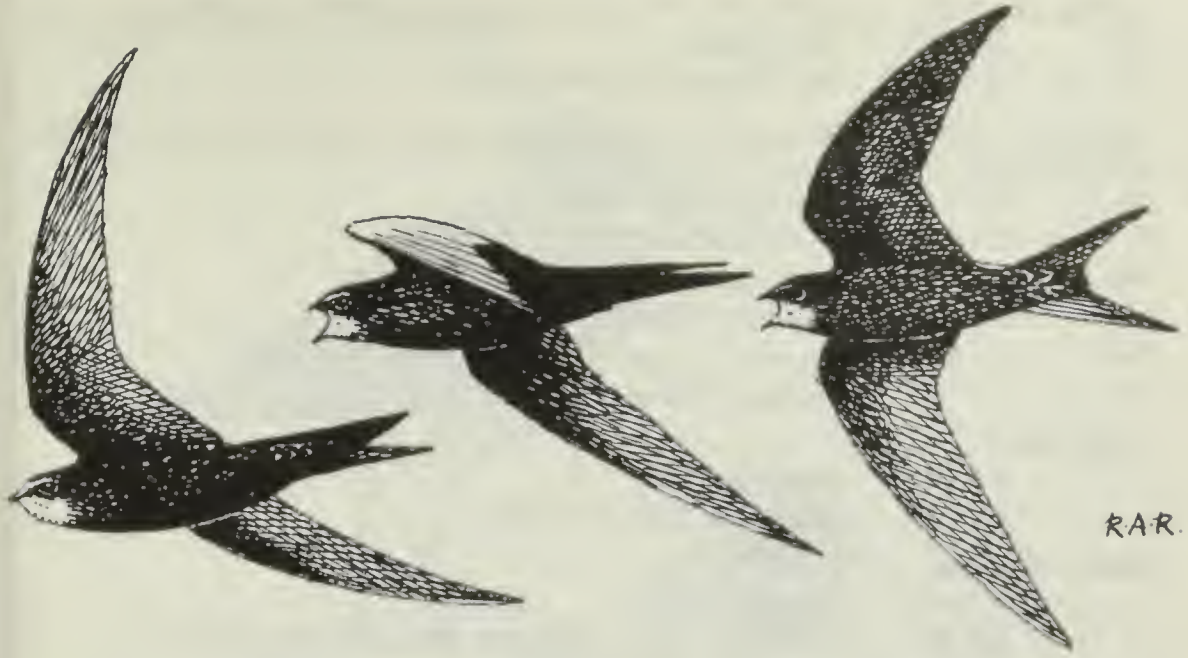
Pied Wagtail: A Suffolk nestling, trapped at roost at Earlham.

1	2.8.88	Eriswell, Suffolk
v	27.10.88	Earlham 52km ENE

Robin: East Coast autumn migrants (mainly from Fenno-Scandinavia) commonly winter in Spain.

3	21.10.88	Ormesby St Margaret
x	16.11.88	Murelaga, Vizcaya, Spain 1,081km SSW

Redstart: It is impossible to establish whether this was a migrant or a locally-bred bird. Note its speed of movement.



3M	11.10.87	Beechamwell
x	12.10.87	Petts Wood, Greater London 139km SSW

Blackbird: The Finnish population (which is of relatively recent origin) has been shown to regularly winter in Britain. The Danish bird is remarkable in that it represents the third Scandinavian recovery from the same Sheringham garden within a 12 day ringing period. (See N.B.R. for 1987).

4M	21.11.87	West Walton Highway
xF	9.7.88	Virkkala, Husimaa, Finland 1,678km NE
5F	16.1.87	Sheringham
v	20.4.88	Danzigmann, Laeso, Denmark 800km NE

Fieldfare:

4F	9.12.84	Gayton
x	21.2.88	Carrigart, Donegal, Eire 596km WNW

Sedge Warbler: More than two-thirds of the foreign recoveries of Sedge Warbler are from France.

3	8.8.87	Cantley
v	24.8.87	Treogat, Finistere, France 661km SW

Reed Warbler:

2	26.7.87	Cantley
?	11.9.88	Huelva, Spain 1,811km SSW
4	18.6.84	Ardennes, France
v	14.6.87	Cantley 379km NNW
3	6.9.86	Litlington, Sussex
v	3.8.88	Redgrove Fen
3J	2.8.88	Weybourne
v	7.9.88	Villeton, Lot-et-Garonne, France 958km S

Lesser Whitethroat: This bird is the national record holder for longevity concerning its species.

5F	21.5.83	Kettlestone
v	22.8.88	Kettlestone

Garden Warbler: This is the first Norfolk bird to be recovered in Africa.

6M	10.9.85	Sheringham
x	20.1.88	Safi, Morocco 2,441km SSW

Blackcap: Wintering Blackcaps are currently being colour ringed to confirm (or otherwise) that they originate from Central Europe.

4F	12.2.87	Bexhill-on-Sea, Sussex
v	17.1.88	West Walton Highway 204km N
3M	17.9.87	Southampton Docks
v	2.5.88	Burnham Market 272km NNE
2M	27.9.86	Hamme St Anna, Oast-Vlaanderen, Belgium
v	15.7.87	Earlham 259km NW

Chiffchaff:

3	4.8.88	Shimpling
v	19.9.88	Icklesham, Sussex 168km S

Willow Warbler:

4	25.4.87	Weybourne
x	7.5.88	Aghanloo, Londonderry, N. Ireland 578km WNW
3	30.8.85	Horsey
v	27.8.87	Queen Mary Reservoir, Surrey 208km SW

Starling: In addition to the recovery published in full, Norfolk winter birds were recovered in the Netherlands, East Germany and the U.S.S.R. reflecting established migratory patterns.

6F	15.1.85	Stoke Holy Cross
x	3.3.88	Rathangan, Kildare, Eire 560km W

Brambling: A typical movement.

5M	19.1.87	Sheringham
x	1.7.87	Storsteinnes, Troms, Norway 2,040km NNE

Greenfinch: All movements outside Norfolk and Suffolk are shown, the Bardsey bird being particularly distant.

5M	18.1.87	East Winch
xF	23.4.88	Girton, Cambridge 61km SSW
4F	28.11.87	East Winch
v	1.4.88	Belmsthorpe, Rutland, Leicestershire 65km W
3M	1.11.87	Bardsey Island, Gwynedd, Wales
v	1.4.88	East Winch 357km E
5M	23.1.88	Swaffham
xF	31.5.88	Upwell, Wisbech, Cambridgeshire 35km WSW
3F	28.12.86	Enfield, Greater London
v	5.4.88	Weybourne 166km NNE
6M	25.4.87	Sheringham
v	26.2.88	Tylers Green, High Wycombe, Buckinghamshire 194km SW
5M	29.3.88	Brooke
x	15.7.88	Kettering, Northamptonshire 144km W

Twite: This record demonstrates the benefits of colour-ringing.

2	?.11.87	Holbeach Marsh, Lincolnshire
vv	9.12.88	Morston

Classified Notes

These notes are based on *Birds of Norfolk* (1977 revised edition) where information regarding status, distribution, migration and ringing recoveries may be found. Attention is drawn to migration observations appearing in the quarterly bulletins of Cley Bird Club and also featuring in NOAs 1988 Annual Report. In addition NARVOS Report for 1988 contains considerable detail regarding distribution in west Norfolk.

The order used is that of K. H. Voous (1977) List of Recent Holarctic Bird Species. Observations refer to 1988, unless otherwise stated. To save space, all but the most essential initials have been omitted. Records are of single birds unless otherwise stated.

Red-throated Diver: Peak counts lowest since 1984: 90 Overstrand Feb 7th, 22 Cley Feb 14th and 22 Paston Nov 20th.

Inland only 2 singles: Heigham Sounds Jan 10th and Thetford GP April 4th-May 4th.

Black-throated Diver: Offshore 12+ records (all singles apart from 2 twice) until March 20th and all between Hunstanton and Weybourne apart from singles off Paston Feb 20th and Caister Feb 25th.

In latter half of year minimum of 25 records with similar distribution commencing with a summer-plumaged bird off Blakeney Point Aug 24th; 3 off Weybourne Dec 3rd. Only 2 East Coast records: Paston Sept 9th and Yarmouth on 14th. In addition Snettisham Pits March 12th-16th.

Great Northern Diver: A minimum of 17 records up to May 25th (Weybourne) and from Aug 4th (Horsey). Two-thirds were from the latter period including 2 off Hunstanton Dec 28th. Distribution much the same as that for Black-throated Diver and all between Heacham and Weybourne except a breeding-plumaged bird off Horsey Aug 4th.

Little Grebe: Breeding records from Breydon (4 pairs in dykes), Berney, Cantley BF, Crimplesham, Devils Punch-bowl, East Tuddenham, Holkham fresh-marshes (8 pairs where breeding first recorded only last year), Pentney, Surlingham Church Marsh and Tottenhill.

Best post-breeding counts: 32 Holkham Park Aug, up to 22 Snettisham Sept-Nov, 19 Wells Boating Pond Nov and 17 Burnham Overy Staithe Dec.

Paston 7 Oct 2nd were the only ones recorded at sea.

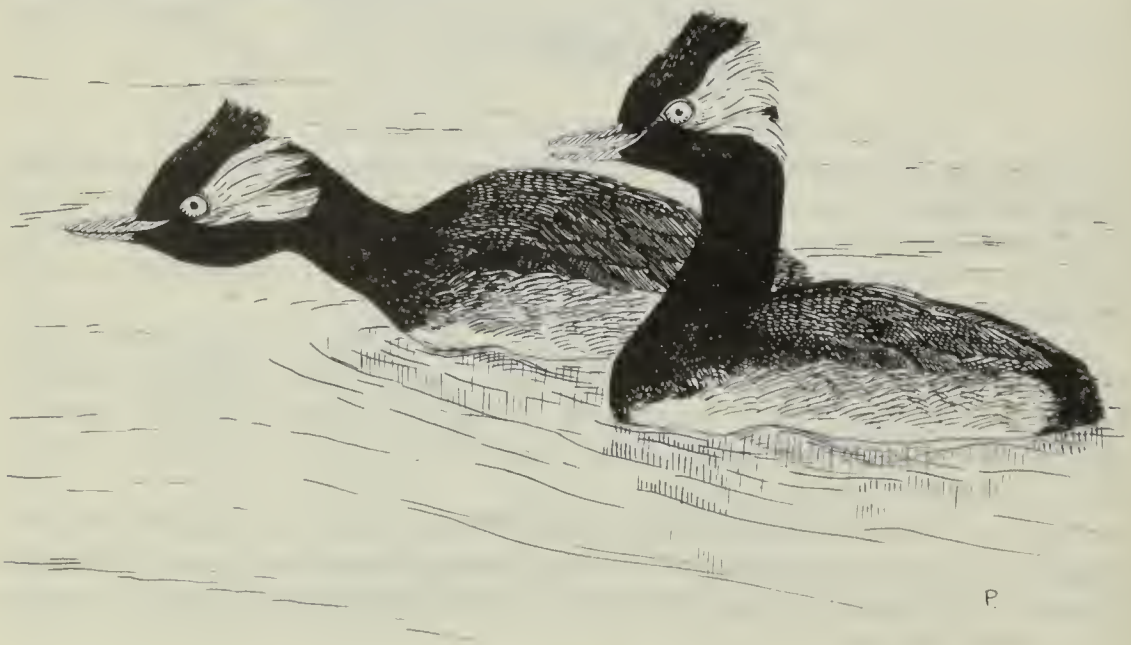
Great Crested Grebe: Cley 25+ flying west in a movement which also involved Red-necked and Slavonian Grebes Oct 8th.

Red-necked Grebe: A great many coastal records of ones, twos and threes, vast majority at the mouth of Wash and off north coast, but also up to 3 off Paston on 5 dates in autumn and off Waxham Sept 20th. Last of spring Hunstanton April 5th and first of autumn Weybourne Aug 5th.

Westerly passage also noted with best counts off Cley where 6 west Sept 13th (strong northerlies) and 15 west together with 5 Slavonian Grebes 0645-0900 Oct 8th (strong SW winds). These movements also observable at other points along the north coast — especially Salthouse and Weybourne.

Inland at Alderfen Broad Nov 13th-20th; Berney Feb 13th-17th (photographed); Blickling Sept 18th-26th (photographed); Heigham Sounds Jan 10th; Hickling Sept 14th/15th; Horsey Dec 7th; Pentney GP Oct 23rd-Nov 4th and Snettisham Pits Jan 22nd.

Slavonian Grebe: Well over a hundred observations, two-thirds during Nov. Distribution strikingly similar to Red-necked Grebe, but with a higher proportion between Hunstanton and Holkham Bay. Peaks of 6 Titchwell Nov 16th, 7 Brancaster next day and 8 there Nov 26th and 7 Holme Dec 31st.



Away from most favoured area singles at Walcott Feb 24th, Paston Oct 30th and Lynn Point Nov 18th.

Inland singles at Holkham fresh-marsh March 9th-20th, Ranworth March 19th/20th and Hardley Flood Oct 16th.

Black-necked Grebe: Despite ever-increasing observation remains very scarce: Pentney GP 2 displaying May 13th/14th and 2 (perhaps the same) at Thetford GP on latter date.

Albatross species: 1986: Happisburgh Nov 9th (JDG). The second county record of an Albatross.

Fulmar: Hunstanton 100 pairs Jan 20th; 55 young on ledges Aug 9th, 5 birds back on cliffs by Oct 17th and 20 pairs by Christmas. In addition a record 40 chicks between Weybourne and Sheringham.

Largest movements offshore: 250 Hunstanton Aug 21st, 168 west Paston Sept 14th when 350 west and 40 east off Weybourne where a first-winter dark bird found freshly dead Sept 24th. Inland: Norwich one east June 4th and East Wretham one south-west following day.

Sooty Shearwater: Salthouse July 29th followed by a typical series of records Aug 21st (Hunstanton) during strong NW winds to Sept 29th (Gorleston) with notes received from 14 dates during this period. No particularly high counts but 7 north Yarmouth Sept 13th, 30 Cley the same day and 7 west there following day when 12 off Weybourne.

An interlude of a month was followed by an interesting flurry of late birds: 5 Waxham and one Winterton Oct 29th; 2 Hunstanton and one Cley Nov 18th and one Waxham and 2 Titchwell Nov 20th.

Manx Shearwater: Only spring records: 5 Waxham May 28th and 5 Cley June 5th.

Between July 15th and Oct 7th impressive totals during strong northerlies. The counts included 128 Cley, 592 Hunstanton (0800-1200), 600 Holme and 560 north and 12 south Gore Point all July 15th; 207 Hunstanton and 90 Holme Aug 21st; 50 Cley Sept 9th; 60 Cley Sept 13th and 300+ Holme Sept 14th.

Inland: Wolferton Common Sept 3rd and a road casualty at Beechamwell on 8th.

Yelkouan Shearwater: Single *mauretanicus* off Cley Aug 29th (DJH), Blakeney Point Sept 3rd (SCJ) and Winterton Oct 11th (BWJ PJH).

Leach's Petrel: A remarkably good autumn: Paston Sept 4th; Cley Sept 9th; Cley 11 and Weybourne 13th; Weybourne 6, Cley 12, Holme and Lynn Point where 2 moving down Ouse 14th; Weybourne, Holme and Cley 15th; Cley 3 16th and another there Oct 11th when 5 off Winterton; Cley Oct 19th and Titchwell Nov 20th.

Gannet: Strong easterly autumn movements visible from many points between Hunstanton and Paston. Best counts 220+ Hunstanton Aug 21st; 511 Weybourne Sept 9th; 1,000 Holme 14th; several hundreds in SW gale Cley 21st and 570 Weybourne and 675 Paston Sept 24th.

Inland 3 NE over Flitcham Sept 7th after dense fog in area of the Wash; another in the Ouse King's Lynn Sept 13th.

Cormorant: Peak roost counts: Ranworth 250 Jan, 354 Feb, 340 March, 358 Oct, 368 Nov and 305 Dec. Welney 132 Jan, 147 Feb, 136 March, 133 Nov and 130 Dec. Holkham 150+ Aug.

Large numbers elsewhere included 122 Breydon Jan and 148 Narford Sept.

Breeding attempted at Narford with 2 nests under construction and 2 birds sitting May 8th but no young reared.

Shag: An amazing year especially for inland records which involved occurrences from Jan to April and in Sept/Oct. Vast majority were apparently wrecked in the west of the county by strong northerlies between late Feb and early April. Mostly ones, twos and threes totalling at least 60 birds Feb 10th to April 11th, but including a phenominal 22 Tottenhill GP March 5th; 6 Wells Boating lake April 4th and 5 Thetford GP next day. Two of the 3 birds which arrived at Oxborough Hall moat March 5th died (the survivor lingered till 29th). Other casualties found at Thornham, Ringstead and East Rudham March 7th-9th. At Dersingham an immature alighted on the school roof March 25th.

Other records from all parts of the coast and in all months with largest numbers as follows: 19 Hunstanton March 3rd; 10 SW there March 8th; 10 west Cley and 10 Paston Sept 12th and 10+ Cromer Pier 13th; up to 5 roosted on Sheringham cliffs in early Oct.

Bittern: Ten regular boomers, divided equally between the reedbeds of the Broads and those of the north coast.

Winter records from Alderfen Broad; Barnham Broom Fen; Filby, Hickling and Rollesby Broads and Thompson in early part of year and in Oct/Nov/Dec at Barnham Broom Fen, Berney, Burnham Deepdale, Catfield, Hickling, Horsey, How Hill, Rockland, Strumpshaw, Sturston and Tottington. One was released from a Coypu trap at Welney.

Cattle Egret: Tunstall, an adult in breeding plumage following the plough Aug 9th (KC) appeared at Minsmere later in the day. The seventh county record.

Additional 1986: Heigham Sounds 2 photographed Sept 27th (SEL).

Little Egret: A breeding plumage bird first at Cley 0500 May 14th (RJE KJ DCO-E *et al*), later at Holkham (SB CHD *et al*) and then flying west over Burnham Deepdale (SWH) and Holme (NOA).

Grey Heron: Heronry numbers as follows: Barton 6, Buckenham Carrs 11, Didlington 2, Fleggburgh Common 3, Hickling (Hundred Acre wood one and Whiteslea Wood one), Hilgay 39, Islington 89, Narford 6, North Elmham 9, Old Hunstanton 11, Potter Heigham (Heigham Sounds 8), Quidenham 3, Ranworth 2, Shadwell one, Snettisham 2, Sparham 18, Sturston 10, Surlingham Broad 3, Upton one and Wheatfen one.

A full county survey of heronries is planned for 1990.

Four flew in off the sea at Blakeney Point Oct 1st.

Purple Heron: Weybourne April 19th (MPT JW), Burnham Deepdale an adult May 4th (DWH) and Burnham Norton a juvenile Aug 21st then daily at Holkham fresh-marsh until 30th (JRMcC *et al*).

White Stork: Blakeney (TA), Stiffkey (RM) and Snettisham (PF) April 1st. Next day at Snettisham again (PF RAI), Hunstanton (CHD) and Titchwell (CBC).

Spoonbill: Ones and twos from April 21st (with 4 east at Salthouse May 14th) at Breydon, Cley, Gimingham Mill (briefly), Hickling, Holkham, Holme, Salthouse, Snettisham, Titchwell, Woodbastwick and Yarmouth. Regular movements between Holkham and Cley fresh-marshes confirmed by presence of a group of 3 including a colour-ringed immature.

A late series of records probably all refer to the same immature from Oct 21st until year-end at Brancaster, Cley, Holme, Snettisham, Titchwell, Wells and Wolferton.

Bewick's Swan: Recorded to March 31st and from Oct 19th. As usual largest concentration on Ouse Washes (Cambs/Norfolk): 3,787 Jan, but only 222 Feb 22nd due to mild weather causing early departure. In addition high flooding on Ouse Washes casued many to move to Nene Washes where lower flooding levels. Six injured birds summered at Welney. In autumn (complete Ouse Washes) 640 Oct, 1,300 Nov and 3,700 Dec 19th (when 2,200 roosting at Welney). At this time 13% young birds.

Wintering birds in Broads/SE Norfolk peaked at 220 Jan, 360 early Feb, 480 Nov and 300 Dec. Newly flooded Berney Marshes attracted 691 Feb 21st, 700 Feb 22nd and 495 March 1st.

Whooper Swan: Recorded at Welney to April 15th and from Sept 30th when 16 arrived. Largest numbers there included 505 Jan (when 582 on complete washes), 423 Feb, 339 March, 200 Oct, 365 Nov and 494 Dec; only 9.7% young. Two injured birds summered.

Broads (Hickling/Horsey/Waxham): Up to 72 Jan, 32 Feb, 45 Nov and 50 Dec.

Bean Goose: 1987/8 winter: Yare Valley. Last 7 departed Feb 15th. 1988/9 winter: Autumn return to Yare Valley from Nov 19th when 138 arrived increasing to 178 by Dec 7th with peak of 350 by Dec 14th. Total of 17 birds again present out of 22 carrying neck collars and identified here in previous winter.

Elsewhere: Hickling/Horsey/Waxham up to 16 till Feb 28th; Cley 3 Jan 26th and Holkham up to 12 Jan 2nd to April 2nd.

Pink-footed Goose: As in recent winters co-ordinated dawn counts on The Wash and on the north Norfolk coast indicated the following figures for the combined wintering population in NW Norfolk: 1987/8 winter: Peak of 18,800 Jan 9th declining to 8,800 Feb 6th. Last 150 at Snettisham April 1st.

1988/9 winter: Early arrival (15) Sept 17th increasing to 67 by 26th, 9,150 Nov 6th, 13,100 Dec 4th, peak of 13,500 Jan 8th and 7,600 Feb 5th.

Possible extensions of range: 100 feeding on Salthouse marshes till fog cleared Jan 17th; also 200 over Northrepps Dec 16th where 22 in winter wheat and 30 in beet next day.

One at Holkham Feb 29th 1988 had been ringed at Martin Mere (Lancs) April 3rd 1987 and was re-sighted there Dec 9th 1987. Elsewhere 60 Cantley briefly Dec 17th.

White-fronted Goose: Holkham/Wells monthly maxima: 265 Jan, 275 Feb, last March 19th, first returning Oct 3rd, 115 Nov and 166 Dec. Breydon/Berney: 14 Jan, 95 Feb

and 23 Dec; elsewhere in Yare Valley 252 Jan, 130 Feb, 80 Nov and 125 Dec. Martham 23 Jan, 150 Feb and 45 March. Welney: 80 Jan 1st-3rd, only 41 by 8th and 8 by 18th.

Lesser White-fronted Goose: The Yare Valley bird reported Jan 26th 1984 (and published in 1985 NBR) now rejected by British Birds Rarities Committee.

Barnacle Goose: Small influx reached north coast Oct 21st when 32 Weybourne flying in thick fog before settling at Cley where 9 remained in area till Nov 6th; 3 at Holkham followed shortly by 4-6 at Titchwell/Thornham. Earlier, 5 in Holme/Thornham/Scolt area from Oct 4th included one ringed bird. Reading the ring number through a telescope indicated it had been marked in Denmark in a previous winter.

Brent Goose: A co-ordinated count on north coast (Holme to Salthouse) in Jan 1989 produced a total of 12,711 birds. Proportion of young in flocks nationally: 34.4%, but in north Norfolk 39.6%. Twelve colour-ringed birds recorded of which 9 present in previous winter. A bird ringed at Salthouse 1974 was sighted in Dec making it at least 15 years old. A leucistic bird returned to Scolt Oct 24th for its seventh winter.

Wash: Ouse Mouth 1,200 Jan 9th; Lynn Point 1,200 March 5th and 1,500 Nov 27th.

Pale-bellied *hrota*: 1-4 at usual localities.

Black Brant *nigricans*: 1/2 remained in Blakeney/Cley, Salthouse/Weybourne area till March 12th with another at Stiffkey and Wells from Oct 27th. In addition single Titchwell Oct 18th. At Lynn Point Jan 1st to April 19th and Nov 20th-27th.

Red-breasted Goose: The bird arriving Dec 7th 1987 remained largely in Salthouse/Cley/Blakeney area till March 2nd. Also traced to Stiffkey and Saxlingham.

Egyptian Goose: The following summary has been extracted from a paper by WJS and GA: Distribution in Britain is now practically limited to Norfolk. 144 pairs were located during the 1988 breeding season the majority in north and western parts of the county. Of this total over two-thirds were in parkland. The population is estimated between 350 and 400 birds. Breeding success is poor. Close observation of the 59 pairs at 23 sites revealed a total of 63 young by July. This low productivity may be partly due to the spread of birds with small goslings extending from Feb to Sept. There is a moult-migration to Holkham lake which has a moulting flock of some 150 birds. Breeders from the Wensum and upper Bure moult at Sennowe and Blickling.

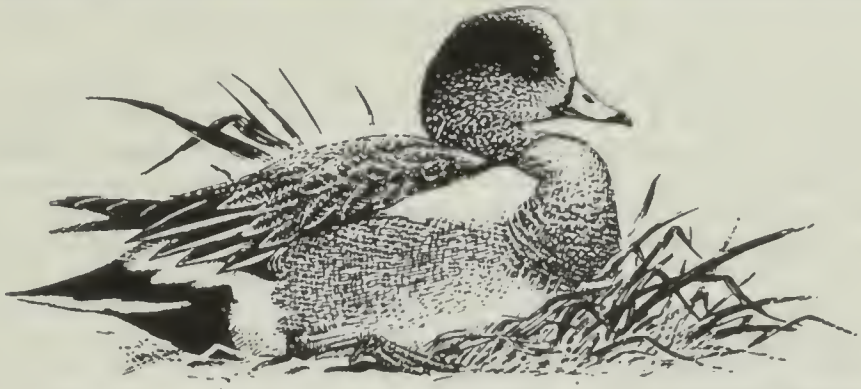
Shelduck: Wash counts at Snettisham included 3,450 Jan, 2,244 Feb, 2,171 March, 870 June, 555 Sept and 830 Oct, moulting flocks included 4,000 in Peter Black Sand/Bulldog Sand area Aug 10th.

Inland breeding at Baconsthorpe Castle, Berney, Bittering GP, Blickling, Cockley Cley, Flitcham, Fleggburgh, Hardley, Hickling, King's Lynn BF, Pentney GP, Rockland Broad,

Shammer, Stanford Water, Strumpshaw, Surlingham Church Marsh, Thompson Water, Tottenhill, Welney and West Acre.

Mandarin: 1-2 at Anmer, Flitcham, Hickling and Norwich; also 9 Guist.

Wigeon: For many years the Ouse Washes have been the most important inland site for wintering Wigeon in Britain. Since the rapid drop in numbers wintering at Lindisfarne in recent years it has now become the premier Wigeon site in Britain. Highest Welney estimates include 7,140 Jan, 7,650 Feb, 5,430 March, 1,770 Sept, 5,380 Oct, 10,850 Nov and 10,980 Dec. Peaks elsewhere: Berney 1,625 and Buckenham 8,460 both Jan.



American Wigeon: A duck shot in error near Holkham Feb 2nd (skin held by NVMcC). Single drakes at Berney May 23rd-24th (PRA KRD LCS) and at Welney Dec 10th-27th (PC CD JBK RN *et al*).

Gadwall: Most impressive counts at Narford (525 Sept 18th) and at Gunton Park (461 Sept 18th and 165 Oct). Elsewhere: Belaugh 57 Nov, Berney 79 Dec, Stanford Water 81 Nov, Strumpshaw 90 Nov, Snettisham 57 Feb, Thompson Water 54 Feb, Tottenhill GP 60 Oct and Welney 113 March.

Teal: Highest counts included 1,245 Welney Jan and 993 there Feb; 800 Titchwell Oct and 500 Tottenhill Nov.

Green-winged Teal: Single drakes at Hickling April 28th-May 1st (AS *et al*), Berney May 7th (PRA LCS), Titchwell Nov 19th-23rd (CHD *et al*) and Tottenhill GP Nov 27th-Dec 12th (MSR DWH *et al*).

A drake at Wells Nov 24th 1985 has been deleted from the county records as stated in 1987 NBR. It formed part of a local waterfowl collection, but we have been asked to point out that Wells Wildfowlers Club was not involved in the release programme.

Pintail: Highest totals: Breydon 189 Feb, Lynn Point 236 Feb and 240 March, Narford 866 Sept, Snettisham 640 Jan and 2,230 Feb, Tottenhill GP 70 Nov and Welney 300 Jan and March, 1,000 Oct and 1,200 Nov.

Garganey: Spring arrival from March 27th (Snettisham) followed by observations at Berney, Cantley, Cley (10 July 31st), Gillingham, Hardley Flood, Heckingham, Hickling, Holkham (5 May 30th), Holme, Lakenheath Washes, Ouse Washes, Pentney GP, Reedham, Salthouse, Snettisham, Strumpshaw, Surlingham Church Marsh, Titchwell, and Tottenhill GP.

Single pairs bred successfully at Cley and Ouse Washes (county boundary). Latest Welney Oct 14th.

Shoveler: Largest totals: Berney 123 March, 122 April and 90 Dec; Cantley BF 115 July; Narford 1,280 Oct and Welney 219 Jan and 256 Feb.

Red-crested Pochard: Blickling 3 Nov 20th-24th; Cley July 21st-29th and another Sept 4th; Guist Oct 30th; Lyng GP 2 Oct 8th; Narford Jan 3rd and Strumpshaw Nov 27th-Dec 31st. Local status confused by escapes from collections.

Pochard: Largest counts: Colney GP 187 March, Narford 125 Jan, Pentney 236 Oct and 242 Nov, Strumpshaw 170 Feb, Tottenhill GP 294 Feb and Welney 820 Jan, 1,082 Feb and 746 Dec.

A Pochard × Tufted hybrid drake Tottenhill GP Jan 19th-March 2nd and again from Dec 4th.

Breeding summary: Pochard are known to have bred in the county since 1815 — at Scoulton Mere while Stanford was referred to as long ago as 1836.

Breckland remains a stronghold. Since publication of the revised edition of *Birds of Norfolk* (1977) Breck breeding localities have included Bagmore, Buckenham, Cockley Cley, East Wretham, Fowl Mere, Lynford, Mickle Mere, Smoker's Hole, Stanford, Sturston, Thompson Water and Common, Tottington, Weeting, West Mere and West Tofts.

In Broadland, spasmodic nesting was first recorded in 1928, but it was not until 1956 that breeding became an annual event. Since 1977 Broads breeding localities have included Barton, Berney, Buckenham, Cantley BF, Filby, Haddiscoe Island, Hardley Flood, Heigham Sounds, Hickling, Horsey, Hoveton, How Hill, Muck Fleet, Neatishead, Ormesby, Ranworth, Rockland, Rollesby, Strumpshaw, Surlingham and Wroxham. It is worth mentioning that in early summer 1984 the remarkable total of 49 pairs was recorded on the Flegg Broads (Filby, Rollesby, Lady and Ormesby) alone.

Riviere's *History of the Birds of Norfolk* (1930) records Pochard nesting at Cley in 1923/4 and probably 1929. More recently one/two pairs bred at Holkham Lake in 1984/5 and the recently flooded Holkham fresh-marsh attracted 2 breeding pairs 1988. Elsewhere in the county the only known breeding localities are Swanton Morley GP (1983/4/5), Colney/Bawburgh GP (1984/5), Sparham, Pensthorpe and Snettisham.

Annual breeding details are unfortunately lacking at some sites and traditional localities are abandoned from time to time. However, the distribution remains substantially as shown in *The Norfolk Bird Atlas* (1986) with no further expansion of consequence. The county breeding population at the present time is approaching 100 pairs. Unlike Tufted Duck, Pochard have hardly begun to colonise and breed regularly on flooded gravel pit complexes. Quite why is a mystery.

Tufted Duck: Maximum counts: Bawburgh/Colney GP 195 Feb, Narford 135 Jan, Pentney GP 222 Nov, Stow Bardolph 182 Feb and 500 Nov, Tottenhill GP 380 Nov and Welney 405 Jan. A leucistic individual Stow Bardolph Dec 1st-5th.

Breeding summary: Tufted Ducks have bred regularly in Breckland since 1873 when the first Norfolk nest was found at Merton. The meres and lakes remain a stronghold in the county including 7 regular 'Battle Area' sites.

At the time of publication of *Birds of Norfolk* (1967) the only appreciable extension of range which had taken place was to the Fenland borders at Stow Bardolph, Hilgay and Runcton Holme in 1958.

In north Norfolk, pioneer pairs bred at Blickling and Ingworth in 1957 followed by a pair at High Kelling from 1959, 3 broods at Marsham Bolwick from 1965 and the first brood on the Glaven at Cley in 1966. However, it was not until 1968 when 5 pairs bred in the vicinity of Holt that numbers really began increasing. Salthouse was colonised by 1978; Melton Constable Park, Holme and Titchwell (5 pairs) all in 1980; followed by Brancaster (4 pairs) 1982, Scolt Head Island 1985 and Holkham fresh-marsh 1987 (6 pairs in 1988).

Sporadic breeding had been recorded in Broadland between 1912 and 1928. Then followed a remarkable gap of almost 40 years before Hickling recorded a single brood in 1967 increasing to 10 broods within 2 years. A decade later nesting was first recorded at Coltishall 1979, Filby from 1980 (3 years later 15 pairs were nesting on the Flegg Broads) and also Hoveton; Strumpshaw from 1981 (6 pairs 1987), Rockland from 1983; Cantley from 1984 and both Ranworth and Surlingham Church Marsh from 1985.

Further colonisation in the Fens included Wisbech SF (part Lincs and part Norfolk) in 1969 followed by 15 broods at Welney on the Ouse Washes in 1974 with 100 ducklings there 1975. Surprisingly none nested successfully at Welney 1988.

In Central Norfolk 1970 saw broods on the flooded pits at Colney, Bawburgh, Sparham and Corpusty. By 1984 Colney/Bawburgh held 8 broods and a total of 54 young the following year. Traditional sites are at times abandoned: Lyng Easthaugh contained 75 young in 1979.

Most recent extension of range has been on the edge of the Wash. At Snettisham 6-8 pairs nested 1985-1987, but none in 1988. As remarked in *The Norfolk Bird Atlas* (1986) the Tufted Duck "has

exploited nearly all suitable expanses of inland water and has begun to nest along sluggish stretches of rivers, in the Ouse Washes and by coastal lagoons''. During the survey (1980-1985) they were recorded in 270 tetrads. Each recording unit measured 2km × 2km. This impressive total included 133 units where breeding was confirmed.

Scaup: Largest numbers: Breydon 25 Oct, Heacham 19 Jan, Holkham 30 Oct and Snettisham 20 Feb.

Inland records from Colney GP April 30th, Gillingham Oct 21st-23rd, Stow Bardolph 7 Dec 30th, Tottenhill GP 1-3 Nov 1st-12th and Welney 11 Dec 9th diving for submerged potatoes.

Eider: Highest counts included Hunstanton/Holme 100 Oct, 104 Nov and 95 Dec; Brancaster Staithe 140 Dec and Blakeney Point 131 west Nov 23rd.

Inland: Strumpshaw found dead Oct 18th and Filby Broad drake Oct 24th.

Long-tailed Duck: Most regular off Hunstanton/Holme where 24 Jan, 25 Feb, 50 March, 40 April, 17 Oct, 30 Nov and 13 Dec.

Periodic records elsewhere included Titchwell 37 Nov and 25 Dec; Brancaster 19 Nov and 29 Dec; Holkham 8/9 Nov/Dec; Blakeney 13 Nov; Cley; Cromer 17 Nov; Paston 11 Nov; Waxham 4 Nov and Winterton 3 Nov.

Wash: Snettisham Pits 1-4 Oct-Dec. Inland; Breydon Nov 29th to year-end and Filby Broad Dec 3rd. At this time 5 Holme Broadwater, single Titchwell Reserve, up to 19 Brancaster harbour, 3 Burnham Overy Staithe and 14 Blakeney harbour.

Common Scoter: Inshore counts: Heacham 800 Dec, Hunstanton/Holme 250 Jan and 150 June, Titchwell 400 west Nov 2nd, Cley 200 west Oct 24th, 660 west Oct 30th and 200 Nov 19th and Paston 426 west Nov 20th.

Inland: Colney GP 2 April 9th and Pentney GP Oct 27th.

Surf Scoter: Holme a drake June 19th-24th (PG *et al*). The ninth county record.

Velvet Scoter: Recorded to May 17th and from Oct 2nd. Largest parties: Cley 20 Oct 30th, Paston 16 Nov 20th and Heacham to Holme 19 Dec 22nd and 24 Dec 24th.

Goldeneye: Peak counts: Morston 64 Nov, Brancaster 59 Feb and 55 Dec and Snettisham 43 Jan and 42 Nov.

Smew: 1-5 up to April 8th at Hickling, Horsey, How Hill, Ranworth, Stowbridge, Tottenhill and Welney. At end of year singles at Welney Nov 19th and Wells Dec 7th.

Red-breasted Merganser: Largest numbers: Blakeney harbour 32 Nov, Scolt/Brancaster 47 Nov, Snettisham 84 Feb, 90 Nov and 88 Dec and Heacham 35 Feb and Dec. In Fens singles and 2-4 at Downham Market (Relief Channel), King's Lynn BF, Stowbridge, Tenmile Bank and Welney till March 5th. Also inland at Blickling (drake) Nov 28th.

Goosander: Winter parties up to 6 (and once 11) at Alderfen Broad, Blickling, Breydon, Downham Market (Relief Channel), Magdalen, Ranworth, Stanford, Stowbridge, Tottenhill and Wiggenhall St. Peters.

Ruddy Duck: A pair at Stanford with brood of 5 ducklings constitutes the county's first breeding record.

Elsewhere 1-3 at Alderfen, Barton, Breydon, Blickling, Broome, Cley, East Wretham, Filby, Heacham, Hillington, How Hill, Langmere, Martham, Ormesby, Overstrand (at sea), Pentney, Ranworth, Rollesby, Snettisham, Thompson Water, Tottenhill and Welney.

Honey Buzzard: In West Norfolk where present May 17th to Sept 5th, a male in display throughout this period, but no female observed until mid-Aug. A third bird considered a juvenile in early Sept but uncertain if local breeding successful.

Elsewhere singles Holme April 27th, Norwich May 6th and Holkham Park May 30th.

Red Kite: A spectacular movement of continental migrants moving from winter quarters began March 18th. A summary of sightings is given in date order; doubtless some individuals observed at more than one locality. All records of singles apart from party of 4 on first date:

March 18th: 4 Ringstead/Holme. Singles Alderford, Binham, Brandon Parva, Holkham and Swannington. March 19th: Carbrooke, Cockley Cley, Downham Market, Drymere near Beechamwell, Holkham, Gayton, Grimston, Overstrand, South Runcton and Thetford Warren. March 20th: Frettenham, Gressenhall, Saxthorpe and Wicklewood. March 24th: Hempnall.

April 4th: Buxton and Snettisham. April 6th: Dersingham, Roydon Common and Snettisham. April 10th: Horsey and Shipdham. April 11th: Ringstead. April 12th: Weybourne. April 14th: Hickling. April 16th: Knight's Hill. April 17th Holme and King's Lynn.

In addition Bodney Jan 4th, Wayford Bridge Jan 19th, Hickling May 6th, Norwich Nov 12th and Burnham Norton-Holkham Dec 7th.

Marsh Harrier: County summer total of 34 males and 35 females. 82 young reached the flying stage.

At principal Broads winter roost (shared with Merlins and Hen Harriers) 4 in Jan, 3 in Feb/March and 3 Dec.

At Welney Sept 10th a melanistic type male, very dark but with grey tail and pale patches under primaries — as described in *British Birds* 80: 61-72.

Hen Harrier: Recorded to May 19th (immature male Lynn point) and from Sept 4th (Burnham Norton).

Details available from 9 roost-sites gave peak totals in Jan (25) and Dec (29 birds). At largest Broads roost up to 11 present Jan/Feb and 7 Nov/Dec.

Montagu's Harrier: Recorded April 15th to Sept 9th. A pair (both colour-ringed and both fledged previously from arable crop nests) raised 5 young. In addition 2 females shared

a male; one reared a single young, but the other failed. In the same area 3 (one male, 2 females) non-breeders summered.

Elsewhere total of 22 coastal/Broads migrants with a male in Brecks at Brettenham Heath May 4th.

Goshawk: An increase in records, but due to the possibility of breeding at more that one locality it seems desirable not to publish any details.

Sparrowhawk: Widely reported from numerous localities. In Flitcham/Hillington area prey items included Blackbird, Snipe and Collard Dove. At Northrepps a male took a Great Spotted Woodpecker from the observer's garden bird-table.

Successful breeding reported at 15 sites. Migrants at Winterton totalled 5 March 19th and 7 April 16th.

Buzzard: Occasional singles at Cley, Cockley Cley, Docking, Holme, Hunstanton, Kelling Quags, King's Lynn, Massingham Heath, Mautby, Ormesby, Salthouse Heath, Thornham, Watlington and Winterton. Recorded monthly except Jan and July.

Rough-legged Buzzard: Between Jan and April singles at Catfield, Dersingham, Edgefield, Flitcham, Holme, Horsey/Winterton/Martham (Jan 20th to March 14th), Massingham Heath, Pentney, Snettisham and Wolferton together with Winterton May 13th and Hickling May 27th.

In autumn from Oct 29th onwards at Burnham Deepdale, Burnham Market, Catfield, Heacham, Weybourne to Thornham Point (including Blakeney Point and Holkham), Scolt Head, Sheringham and Winterton.

Osprey: Extreme dates March 18th (West Acre) and Oct 21st (Shereford). Recorded at Blakeney Point, Brancaster, Cley, Cockshoot, Dersingham Fen, Felbrigg, Glandford, Heacham, Hickling (2 May 30th), Holkham, Holme, Horsey, Lyng, Pentney, Ranworth, Roydon, Shereford, Snettisham, Southery, Stanford (2 July 31st), Thompson, Titchwell, Wayford Bridge, Wells, West Acre, Winterton and Wolferton.

Red-footed Falcon: Hickling female May 26th to June 3rd (JSH FR *et al*) was seen once to rob a Barn Owl of its prey.

Merlin: Recorded at well over 40 localities up to May 17th (Weybourne) and from Sept 16th (Salthouse).

Roosting information from 3 sites: Broads (7 Jan, 6 Feb, 3 March and 7 Dec); West (4 Jan, 3 Feb, 2 March and 3 Dec) and Fens (singles up to March and from Sept 25th onwards).

Hobby: Recorded at 55 localities between April 29th (Holme) and Oct 14th (Snettisham). At least 2 pairs bred in Brecks.

Peregrine: Blakeney/Morston Jan 9th, March 1st, March 7th and Oct 24th; Brancaster Staithe Sept 11th; Cley Jan 13th and Jan 26th; Dersingham Fen Jan 9th and 25th, Feb 6th, 15th, 21st and 25th and March 1st; Holme Oct 30th; Sandringham Warren Jan 30th, Feb 6th and March 2nd; Snettisham Jan 24th, Sept 3rd, Nov 19th and 27th; Titchwell Oct 2nd and 7th and Nov 27th; Wells Dec 31st and Wolferton Jan 26th, Feb 6th, Aug 28th and Sept 3rd.

Quail: Calling birds at Burnham Deepdale, Burnham Market (4), Choseley, Holme, New Holkham, Santon, Thornham (2+) and Weybourne.

A migrant on Yankee Ridge, Blakeney Point, May 16th.

Golden Pheasant: Records from Drymere (near Beechamwell), East Wretham, Hockham Fen, Lynford Hall, Merton, Mundford, Narford, Sandringham, Santon Downham, Thetford Warren, Thompson, Wayland Wood, West Harling and Wolferton. No group exceeded 8.

Water Rail: The only summer records: At least 3 nests How Hill; 2 territories Surlingham Church Marsh, 3 territories Strumpshaw and pair with 3 young East Walton.

Spotted Crake: Cley calling April 29th/30th. In autumn: Strumpshaw freshly dead Aug 1st; Titchwell 10th; Welney a tame bird 17th/18th; Cley Aug 30th/31st; Welney Sept 1st; Sheringham killed by cat Sept 8th and Cley Oct 1st/2nd.

Crane: The Broadland population numbered 6 at the start of the year increasing to 7 by the end of the summer and to 9 from late Sept to end of year.

The local population presumably provided the following scatter of mainly spring occurrences: Strumpshaw March 20th; Titchwell and Brancaster 2 April 1st/2nd; Cley, Holkham, Burnham Overy, Titchwell and Holme on various dates between 15th and 21st; Mundford 3 25th; Holkham 2 April 26th-29th and then at Cley May 5th-9th; Cley, Holkham, Snettisham and Wolferton May 6th; Strumpshaw May 7th; Terrington St. Clement 8th; Thornham 9th; Weybourne 13th; Snettisham and Wolferton 17th and Salthouse, Cley and Holme May 29th; Holme and Breydon June 1st; Holme 2 in off sea Aug 16th and Gillingham 2 same day; Breydon and later Haddiscoe Island 2 Oct 10th.

Oystercatcher: Wash (Snettisham) counts included 14,455 Feb 19th, 14,500 Aug 29th and 16,300 Nov 12th; a pure white bird and 2 partial albino all winter.

180 pairs bred Blakeney Point and 83 nests Scolt Head. Inland pairs at 16 sites.

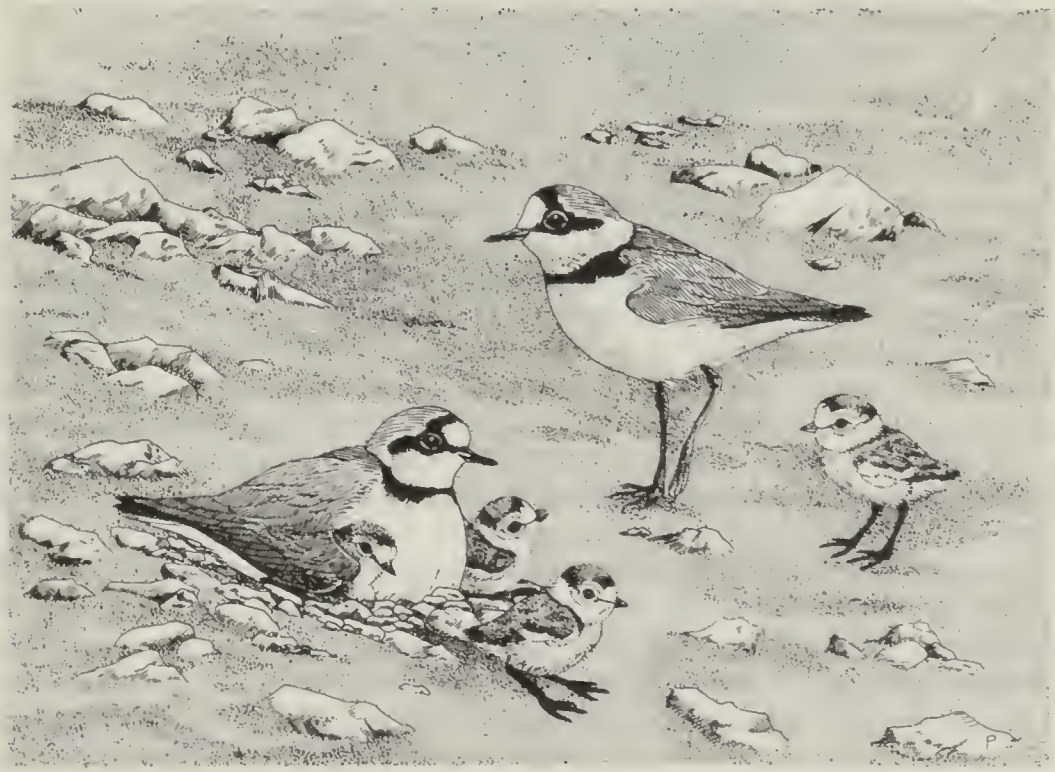
Avocet: Bred at Cley: 85+ pairs with a further 4 pairs rearing 6 young nearby, Titchwell: 42 pairs fledging 50-60 young and Hickling: rearing 2 young.

Feb sightings from Cley 16th, Breydon 21st and Titchwell 24th. Tidal Ousemouth again favoured by post-breeding birds with 60-70 present July-Aug and still 9 Oct 1st. At Titchwell peak of 102 Aug 16th. Otherwise a wide scattering of small numbers elsewhere.

Stone Curlew: Reported between March 21st (Weeting) and Oct 13th (Hockwold). County total of 34 nests fledged 23 young (RSPB). Two post-breeding concentrations of 21 and 9 birds in Brecks during Sept. Blakeney Point June 9th.

Little Ringed Plover: Recorded between March 31st (West Acre) and Oct 2nd (Welney) with a minimum of 31 pairs on territory, nearly half of these reported as breeding.

Autumn flocks of 13 Wissington BF and 8 King's Lynn BF both July 11th and 11 Cantley BF July 24th.



Ringed Plover: Breeding season reports of 10-12 pairs Snettisham, 119 nests Scolt but heavy predation by Fox, Stoats and Kestrels and 55 pairs Burnham Overy-Wells Channel. Ten inland pairs.

Coastal concentrations of passage migrant *tundrae* included 250 Lynn Point May 19th followed by 500 Aug 29th. Snettisham counts of 300 July 31st, 305 Aug 28th and 414 Sept 12th.

Kentish Plover: Singles at Breydon male May 1st, Cley/Salthouse male May 1st/2nd, Holkham female May 3rd, Titchwell male May 10th, Berney May 25th and July 10th.

Dotterel: A wintering bird at Holkham Feb 26th to March 6th associated with Golden Plovers.

A light spring passage with 6 Weybourne May 1st/2nd, Cley May 2nd, Blakeney Point May 27th/28th and Docking/Brancaster May 7th.

Autumn migrants at Weybourne juvenile Aug 20th and 2 west Aug 23rd, Salthouse Aug 27th, Cley Aug 23rd/24th and 27th, Blakeney Point Aug 24th and Sept 6th to 12th and Holme 2 Sept 8th.

Golden Plover: Larger flocks than usual in several areas during both winter periods and spring pre-migration assemblies. Largest flocks: Fleggburgh Common 2,000 flew over Oct 16th, Halvergate 1,200 Jan 11th, Coston 1,000 April 13th, Cley 1,600 March 8th, Boughton 1,000 Dec 10th, West Raynham airfield 1,900 Feb 5th and 1,100 Dec 22nd, Newton-by-Castleacre 1,400 April 8th and Welney 2,000 March 30th and April 24th.

Lessser Golden Plover: The Wisbech SF bird of 10th August 1974 remains only as American or Pacific Golden Plover, but the Breydon Lesser Golden of June 8th-17th 1976 now accepted as American Golden Plover following the 'splitting' by BOU Records Committee of the former two races of Lesser Golden Plover.

Grey Plover: Impressive concentrations on The Wash off Snettisham/Wootton where 980 Jan 24th, 950 March 20th, 3,100 May 15th and 1,130 Oct 28th. Smaller flocks 150 at Thornham Point May 19th, 200 Brancaster Dec 26th and 120 May 20th and 131 Breydon Oct 15th.

More birds inland than normal: Flitcham Nov 18th; Pentney GP May 23rd, Sept 17th and Nov 4th and Welney in Jan, March, Sept (max 4), Oct (11 days) and Dec.

Sociable Plover: A juvenile at Titchwell, then later at Holme Sept 25th (AG *et al*) was the second county record.

Lapwing: Two very large concentrations reported of 9,900 Halvergate/Berney Jan 10th and 3,000-4,000 Necton Dec 16th-30th.

Knot: Largest flocks on The Wash (Snettisham) where 30,500 Feb 21st and still 1,000 summering in mid-June; 5,900 July 30th increasing to 22,210 next day; 28,000 Sept 11th and 35,000 Dec 12th. Also a count of 6,000 Wells Dec 20th.

Inland sightings from Welney where 43 in misty conditions March 19th and Gillingham Marshes Aug 21st to 29th.

Sanderling: Counts from The Wash (Snettisham) of 145 Jan 24th, 150 May 15th, 1,130 July 30th, 1,350 July 31st, 720 Aug 28th and 270 Sept 12th.

Elsewhere 87 Holkham Sept 17th and 105 Hunstanton March 8th followed by 111 there May 22nd.

Inland at Hardley Flood (2) May 9th, Wissington BF May 16th and Aug 14th and Pentney GP May 7th and 15th.

Little Stint: A light May passage observed at Hickling (max 5 on 16th), Berney, Salthouse, Cley (max 4 on 14th), Holkham (max 3) and Titchwell (max 4 on 22nd).

A more widespread autumn movement commencing mid-July with birds reported at 15 sites, passage peaking during first half Sept. Maximum counts included 15 Cantley BF

Sept 3rd, 26 Cley Sept 11th, 13 Holkham Sept 7th, 22 Titchwell Sept 11th, Holme max 12 and 15 Welney Sept 9th.

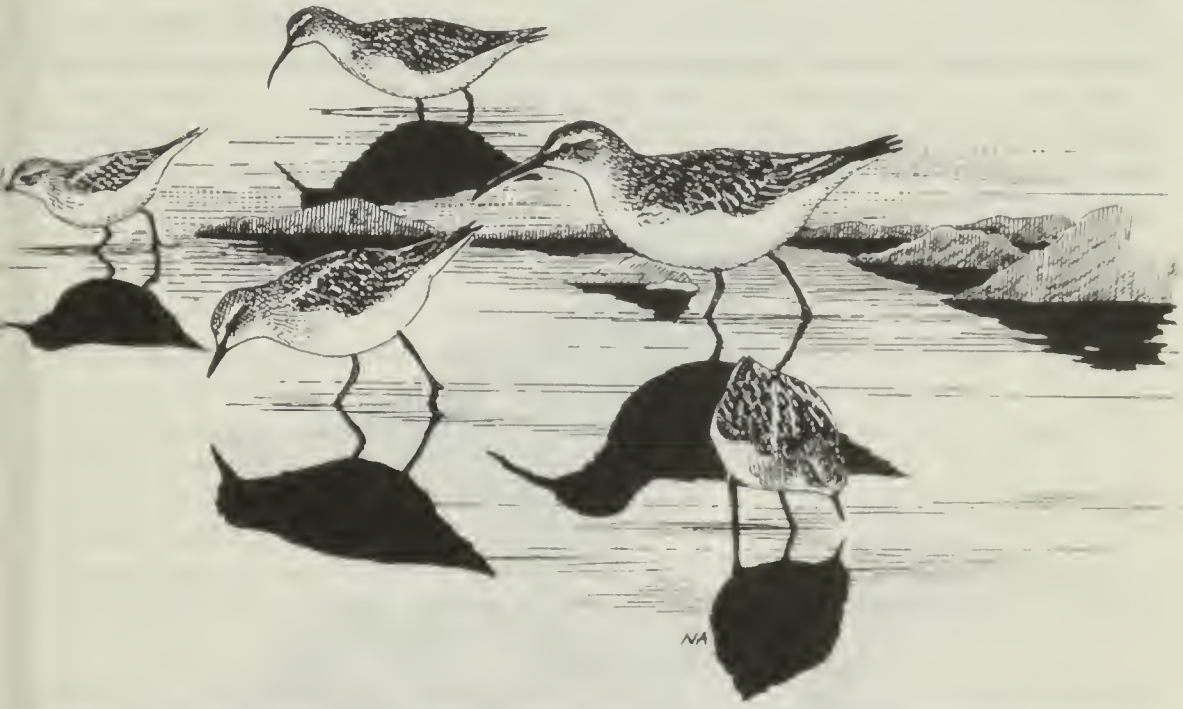
Late individuals at Gillingham Nov-Dec 31st and Cley Nov 27th-Dec 5th.

Temminck's Stint: Spring passage observed at Berney May 2nd-18th (max 4), Hickling April 30th-May 28th (max 2), Cley May 5th-26th (max 3), Lyng Easthaugh May 23rd-26th (max 2) and Welney May 17th/18th. Minimum of 15 birds.

In autumn at Cley July 6th-10th and Aug 19th-28th, Titchwell Aug 22nd-29th, King's Lynn BF July 10th and Wissington BF Aug 1st. Minimum of 5 individuals.

White-rumped Sandpiper: A juvenile at Cley Sept 29th/30th (CRK ETM *et al*).

Pectoral Sandpiper: A good year with birds observed at Cley Aug 28th (PG SJMG) and Sept 27th (HM), Holkham July 12th/13th, July 29th-Aug 6th, 2 Oct 1st and one Oct 3rd (AJ DAH *et al*). Titchwell July 25th/26th (NS) and Welney Aug 7th-15th (JBK *et al*).



Curlew Sandpiper: Spring birds from April 30th at Cley (2) followed by singles at Berney, Breydon and Pentney GP in May and Holkham in June.

A strong autumn passage commencing with a few July adults and peaking with a heavy movement of juveniles from late Aug to early Sept. Recorded at 20 sites with the largest gatherings being 83 Breydon Sept 3rd, 42 Cantley Aug 29th, 67 flying west at Weybourne between Aug 15th-29th, 38 Salthouse Aug 28th, 57 Cley Aug 27th, 43 Holkham Sept 2nd, and 17th, 24 Burnham Overy Aug 28th, 200 Titchwell early Sept, 30 Holme Aug 29th and 250 Ousemouth Sept 6th.

Last bird at Gillingham Oct 24th.

Purple Sandpiper: Extreme dates May 14th (Blakeney Point) and July 20th (Thornham). Counts from main wintering areas: Heacham/Hunstanton 24 Jan, 28 Feb, 25 March, 21 April and 26 Dec; Paston/Walcott 24 Jan, 28 Feb, 21 March, 21 April, 17 Nov and 13 Dec.

A movement of 13 west at Cley Sept 13th. Small numbers widely elsewhere.

Dunlin: Wash (Snettisham) counts of 9,500 Feb 21st, 4,770 mid-April, 5,500 mid-May, 13,880 July 31st, 2,000-3,000 until late Oct increasing to 17,100 Oct 28th and to 20,540 Nov 13th.

An albino at Cley April 1st and Lynn Point April 18th.

Buff-breasted Sandpiper: Singles at Welney July 21st (JBK KW) and Burnham Norton July 31st then Holkham until Aug 16th (DAH *et al*).

Ruff: Wintering birds at Berney 34 in Jan/Feb and 44 in Dec; Cley 20 Jan 2nd; Stiffkey 10 Jan 1st and Welney 45 in Jan and 40 in Dec.

A rather poor spring movement with maximum counts of 24 Welney March 17th, 17 Lakenheath Washes March 19th and 10 Holkham April 13th. No evidence of breeding though lek of 17 Ruffs and 2 Reeves near Welney.

Widespread autumn passage as usual, largest counts being 39 Berney July; 60 Cley Aug 1st, 26 Holkham July 12th, 25 Titchwell Aug 22nd; 40 Welney Aug 20th, 73 Sept 9th, 107 Oct 16th and 99 Nov 5th; 40 Lynn Sept 13th with 28 Oct 31st.

Jack Snipe: Noted up to April 21st (Wissington BF), but not reported in autumn until Oct 19th (Pentney GP). Observed at 22 sites during the year, mostly singles but 3 Surlingham Feb 14th.

Snipe: A county total of 216 drumming birds, the largest concentration being on the Ouse Washes at Welney where 139 displaying in May. Significant numbers of drummers also at Holkham (18), Strumpshaw (18) and Hickling (10).

Highest winter flocks were of 290 Berney (Dec), 100 Martham (Jan), 100 Strumpshaw (Nov), 300 Cley (March), 100 Holkham (April) and 342 Welney (Nov).

Woodcock: 39 roding birds at 22 sites — mostly Brecks and Broads and only giving a hint of true breeding status.

Winter concentrations of 20 (9 shot) Honingham Dec 3rd and 50-60 Cley local woodlands on same date.

Black-tailed Godwit: Spring passage very prominent at Cley peaking at 214 April 19th; presumably Icelandic birds. At Welney a maximum of 100 March 18th. Other smaller parties at several sites including Breydon/Berney, Hickling, How Hill, Holkham, Wissington BF and Lakenheath Flashes.

Peak counts during autumn passage: 76 Cley July 15th, 43 Holkham Aug, 104 Titchwell Aug 8th, 40 Holme July 21st, 200 Wootton July/Aug and 65 Lynn Point Aug 1st.

A few unseasonal reports including 24 Cley Feb 20th, 9 Brancaster/Titchwell Feb 20th and 11 Dec 19th and up to 18 Welney Feb.

Total of 9 pairs on territory in Welney area but only 2 nests of which one successful.

Further information has been supplied by RSPB for the Norfolk section of Ouse Washes. These figures are in addition to the totals at Welney Wash already published in NBR:

	Pairs on Territory	*No of nests*
1985	3	2
1986	9	5
1987	4	3

Spring flooding in both 1986 and 1987 caused considerable disruption.

Bar-tailed Godwit: Largest counts from Snettisham of 5,400 Feb 21st, 1,260 July 31st increasing to an autumn peak of 4,200.

Other counts included 93 Breydon April 30th, 160 Cley (North Scrape) April 17th, 230 Brancaster mid-Feb and 480 Titchwell Aug 30th.

Noted inland with 20-28 Hickling April 30th-May 1st and at Pentney GP 1-2 on 5 dates April-May and 8 Aug 28th.

Whimbrel: Spring passage from March 21st (Cley) while last bird Oct 25th (Brancaster). An unseasonal, lame, individual at Welney Jan 27th.

A substantial spring passage saw flocks of 67 Breydon May 6th and 69 May 11th plus 76 Thornham Point May 8th. Widespread in autumn when main groups included 150 west Cley Sept 1st, 40 Blakeney Point July 16th, 55 Wells Aug 11th, 40 Titchwell Aug 16th, 60 Holme Aug 1st and 300 Ousemouth July 29th flying south inland.

A number of inland records especially on autumn passage: 9 Welney July 26th, 10 Flitcham Aug 4th, 13 Pentney GP Aug 18th followed by 11 there Sept 1st.

Curlew: Maximum Wash (Snettisham) counts 470 March 20th and 1,232 Sept 11th. Birds on territory at Roydon Common as well as breeding at 3 Brecks sites.

Spotted Redshank: A few winter reports: Berney (Jan), Breydon (Jan/Feb and Dec), Wells (Jan-March) and Brancaster (Jan/Dec).

Highest spring passage counts of 7 Berney (June), 11 Cley May 13th, 7 Holkham May/June and 28 Snettisham May 5th.

Largest autumn counts of 8 Gillingham (Aug/Sept), 20 Cley (July/Aug), 54 Snettisham July 31st followed by a peak of 83 Aug 29th and 19 Sept 11th and 8 Welney Oct 20th.

Also reported at Cantley BF, How Hill, Titchwell, Holme and Lynn Point.

Redshank: Largest flocks on The Wash (Snettisham) of 2,678 Feb 21st, 2,671 March 20th, 2,200 July 30th, 3,210 Aug 28th, 3,155 Sept 11th, 3,100 Oct 29th and 750 Nov/Dec.

Marsh Sandpiper: The tenth county record when an adult in summer plumage at Snettisham Pits May 14th/15th (PF RAI). The first county record was as recent as 1979.

Note: The Cley bird July 22nd 1987 was found by M. R. Flack.

Greenshank: Light spring passage from April 14th (Welney), but 22 at Breydon May 7th and up to 10 at Holkham May 24th.

An obvious return movement with substantial counts of 13 Cley Sept 29th, 25 Wells East Hills Aug 3rd, 26 Holkham July 21st and 49 Aug 1st, 30 Brancaster Sept 6th, 16 Scolt Sept 13th, 26 Titchwell Aug 29th, and 20 Sept 26th, 18 Thornham Point Aug 1st, 39 Holme Aug 1st, 11 Snettisham Aug 26th and 12 Cantley BF Aug 26th/29th. Last at Berney Nov 6th.

Green Sandpiper: Wintering birds (Jan-March and Nov-Dec) from 22 sites, mostly singles but 3 Rockland Broad Jan and 5 East Winch and 5 Pentney both Nov.

Spring passage (April/May) more widely reported than normal and involved from 1-4 birds at 12 sites.

As usual widely distributed in autumn, the highest counts being 17 Surlingham Aug 11th, 27 Cantley BF July 24th and 45 Aug 26th, 10 Horsey, 18 Holkham July 23rd and

13 there Sept 5th, 11 Holme July 9th-31st, 11 King's Lynn BF July/Aug and 20 Wissington BF Aug 9th and 25 Sept 22nd.

Wood Sandpiper: Spring passage commenced on the early date of April 16th (Burnham Overy) with 1-4 at a further 10 sites April 28th to June 15th.

A relatively light autumn passage from 12 localities, maximum numbers being 10 Hickling Aug 22nd and 6 Holme Aug 20th. Last at Wissington BF and Gillingham Sept 28th.

Terek Sandpiper: One Holkham fresh-marshes June 18th (JRMcC BRS *et al*) was the sixth county record of a species first recorded during 1975.

Common Sandpiper: Winter records from Cley (Jan-March), Rollesby Broad Feb 27th and King's Lynn BF all Dec and into 1989. Otherwise extreme dates April 17th (Pentney GP) and Nov 3rd (Cley).

Two sizeable spring gatherings: 21 Breydon May 11th and 10 Lakenheath Washes May 13th.

A fairly typical autumn passage, largest concentrations being of 21 Breydon July 25th and 23 Sept 6th, 21 Berney Aug, 23 Cantley BF July 24th and 26 Aug 26th, 15 Hickling Aug 1st, 31 Paston Sept 14th, 14 Holme July 15th-31st, 14 Snettisham Aug 22nd, 21 Lynn Point July 27th, 21 King's Lynn BF July 22nd and 26 Wissington BF Aug 15th.

Turnstone: Largest counts at Snettisham during the autumn: 654 July 31st, 867 Aug 28th, 645 Sept 12th and 200-250 to end of year.

Inland migrants at Gillingham Marshes 2 Aug 6th; Pentney GP April 14th and 3 May 8th and one May 9th; Wissington BF 3 May 6th and Lakenheath Washes May 13th.

Red-necked Phalarope: A female at Holkham April 25th to May 2nd (MSR CHD *et al*) followed by one at Cley July 15th (PG).

Grey Phalarope: An unusual winter record from Horsey Mere Feb 14th (DJH) followed by 4 autumn birds: Cley Sept 13th and 14th, Holkham Sept 17th/18th and Snettisham Pits Oct 10th.

Pomarine Skua: An atypical record of 2 Holme Jan 7th. Also 2 rather late observations of singles from Holme Dec 5th and Heacham Dec 24th.

Autumn passage commenced Aug 22nd and higher than average numbers were seen from many locations around the coast, peak days being Sept 24th (43), Nov 18th (57) and Nov 20th (86) — bracketed figures show county total for each date. Monthly totals: Aug 2, Sept 107, Oct 62, Nov 179 and Dec 2. During the Nov 20th influx 12 off Lynn Point most of whom followed the Ouse inland. An unusual inland record of an immature Chedgrave Oct 1st (photographed by JCE).

Arctic Skua: A few June records: Blakeney Point on 9th, Weybourne on 25th and Holme on 26th.

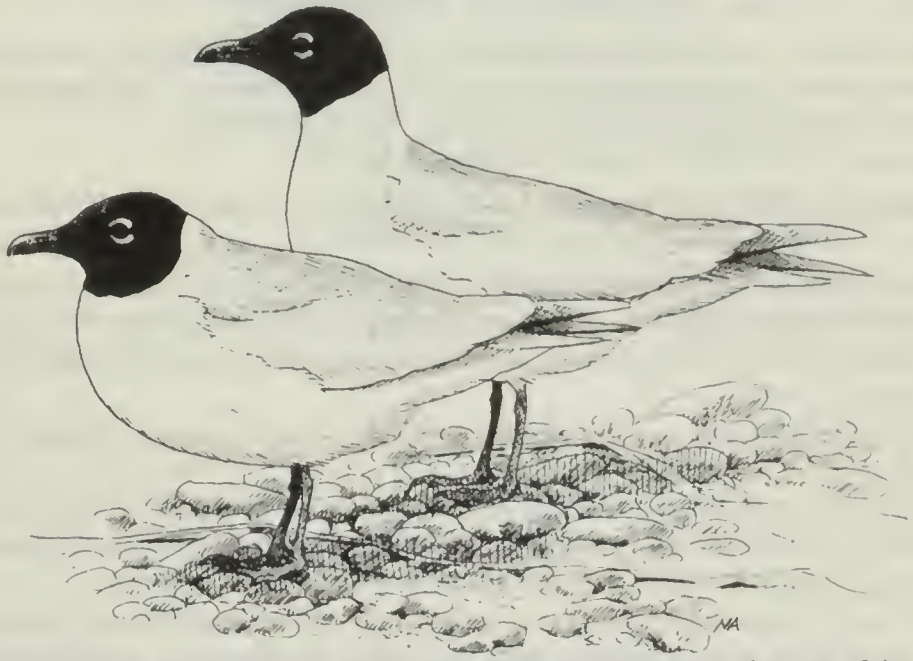
Autumn passage observed between July 15th and Nov 20th from many coastal sites. Selected peak counts: Paston 52 Sept 12th and 100 Sept 24th, Sheringham 100 Aug 19th,

Weybourne/Cley 70 Aug 21st, 76 Sept 12th with 60 next day, Holme 100 Sept 14th and a late movement of 18 Nov 18th, Hunstanton 150 Aug 21st, 60 Sept 13th, 45 Oct 7th and a late movement of 30 Nov 18th and Ousemouth 300 Aug 21st of which 200 flew inland and 58 on a similar course Sept 12th.

A juvenile inland over centre of Norwich Sept 16th.

Long-tailed Skua: A total of 28 individuals from 8 coastal localities Aug 26th to Oct 8th, passage peaking in Sept. At Ousemouth 6 (including 4 adults) headed inland Sept 12th as very strong northerly winds developed (GMSE). Equally unusual a total of 6 west off Cley during SW gale Sept 24th (GED).

Great Skua: Two winter records: Holme Jan 10th and Hunstanton Feb 29th. Autumn passage first noted July 15th when 6 off Cley, followed by a peak of 30 Sept 13th. Other larger movements included 25 Waxham Sept 13th, 31 Weybourne Sept 24th, 30 Holme Sept 30th, 43 Hunstanton Sept 14th followed by a late movement of 16 Nov 18th though several other Nov reports elsewhere of 1-8. At Ousemouth 7 flew inland Sept 12th.



Mediterranean Gull: An abundance of records again especially from the east of the county. Yarmouth: 2 adults Jan/Feb, an adult March, adult July 12th, 2 adults Aug/Sept, 4 adults + a second winter during Oct and an adult Nov/Dec. Breydon had a 1st summer May 12th-29th, juvenile Aug 24th, adult Aug 25th and 1st winter Oct 13th/16th. Nearby a juvenile at Berney Aug 16th.

Cley/Salthouse/Blakeney Point: 2 adults March 24th, 1st summer May 2nd, May 12th/13th, adult July 22nd and most of Aug as well as Sept 4th, 9th, 12th and Oct 21st, 1st winter Sept 26th and Oct 20th.

Other records included Hickling adult April 30th; Martham 2nd winter Oct 13th; Overstrand 2nd winter Jan 1st-March 10th, 3rd summer July 10th, adult winter Oct 2nd-Dec 31st; Weybourne 1st summer May 11th and June 29th, juvenile Aug 28th, 1st winter Sept 18th and adult Oct 4th; Cromer adult Nov 5th-20th (the Overstrand bird); Sheringham 2 March 24th; Holkham 1st summer July 17th; Brancaster adult Oct 12th; Docking adult Oct 23rd; Titchwell adult March 3rd; Holme May 9th; Hunstanton adult March 3rd/4th and Dec 20th; Heacham Aug 16th, adult Oct 19th and Nov 5th, 2 (adult + 2nd winter) Dec 20th; King's Lynn-Lynn Point 1st winter Feb 7th-28th, 2 (adult + 1st winter) Sept 12th-15th and 1st winter Sept 24th; Snettisham adult March 5th, 2nd summer May 7th/8th, juvenile Aug 19th, 1st winter April 29th, May 6th/8th and 22nd, adult Sept 7th, 1st winter

Oct 8th and 2 different 1st winter at Ashill on Breck border following ploughs Nov 10th and 17th.

Additional inland 1985: Denver Sluice juvenile Aug 3rd.

Little Gull: Several offshore in opening months of year when reported from Paston Feb 23rd, Weybourne 2 Feb 15th, Titchwell Feb 27th and Hunstanton 12 Jan 21st, 6 Feb 13th, 9 Feb 23rd and a single March 1st. Late in the year noted off Brancaster 8 Dec 29th and Scolt 14 Dec 28th.

Small spring passage of 1-6 birds at several sites (mid-April-mid-May) including inland waters: Breydon, Berney, Filby, Hickling, Hardley, Elsing GP, Thetford GP, Salthouse, Cley, Titchwell and Welney.

First juvenile of the autumn at Yarmouth Aug 14th. Autumn passage most evident Oct/Nov with particularly large concentrations off NW Norfolk; some overlapping of counts no doubt: Brancaster 74 Oct 17th and 54 Oct 30th; Titchwell 170 Oct 31st and 130 Nov 2nd; Holme 85 Oct 15th, 101 Oct 29th and 100 Nov 4th; Hunstanton 60 Oct 17th, 100 Oct 29th and 240 Nov 2nd and Heacham 76 Oct 19th.

Sabine's Gull: 14 individuals reported, mostly along the north coast commencing with a second-summer bird off Hunstanton July 15th and ending with a juvenile Snettisham Oct 29th. Monthly sightings: July 1, Aug 2, Sept 9 and Oct 2.

Additional 1987: Holme adult Oct 18th (KJ MR SW).

Black-headed Gull: Breeding pairs included 350 Scolt, 2,250 nests late May Warham saltings, 1,500 Blakeney Point and 644 Snettisham.

Common Gull: One pair at Scolt made a scrape, but no eggs laid.

Lesser Black-backed Gull: 6 pairs bred Blakeney Point and 4 nests Warham saltings. Concentrations of 145 flying to roost East Tuddenham Sept 1st and 100 Little Melton Sept 8th following plough.

Herring Gull: Breeding records from Blakeney Point (27 pairs) and Warham saltmarsh (9 nests).

Northern race *argentatus* (breeding between Scandinavia and the White Sea) recorded Weybourne, Blakeney Point and Heacham. Yellow-legged birds at Strumpshaw 2 adults July 31st, Tunstead 2 adults Aug 30th and Cley Dec 10th.

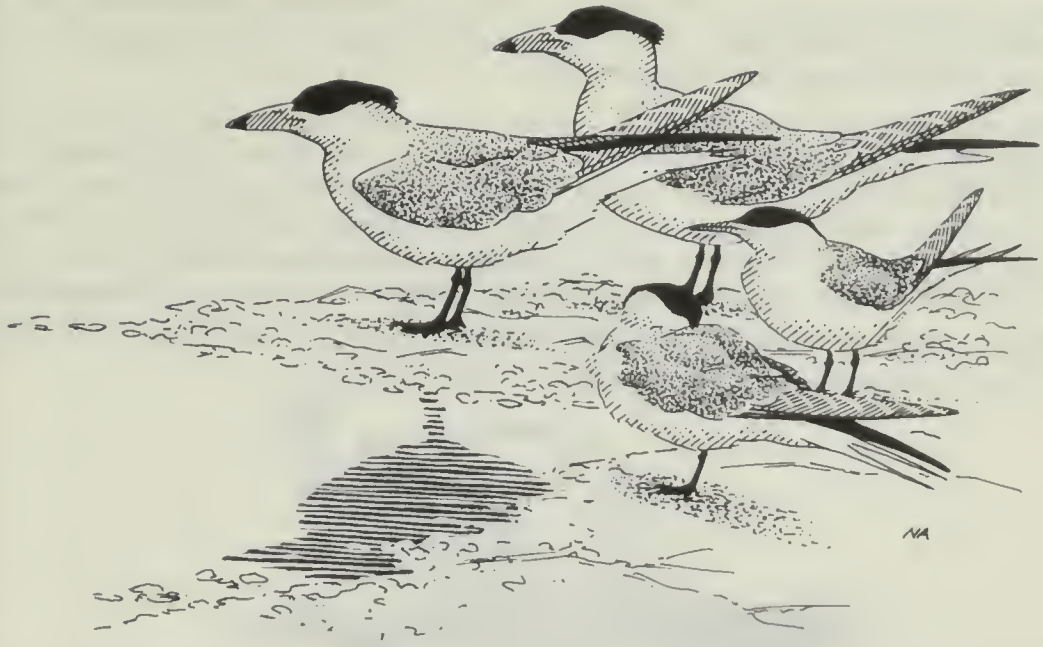
Iceland Gull: Typical small selection of records from Winterton 1st winter Dec 4th, Paston 1st winter Feb 7th, Cley 1st winter Nov 20th, Holme 3rd summer May 29th, Hunstanton 2nd winter March 5th/6th and Heacham adult Dec 20th.

Glaucous Gull: Scattered records from Breydon 2nd summer May 2nd, 1st summer June 3rd and July 30th and an adult Oct 30th; Winterton/Horsey 1st winter Nov 20th; Heigham Holmes Dec 10th; Happisburgh immature Dec 26th; Mundesley 1st winter Jan 31st; Overstrand-Paston 2nd winter Feb 20th; Cley-Blakeney Point-Weybourne adult until March 6th and from Sept 18th, 2nd winter Jan 24th and March 1st, first winter Feb 20th and Nov 19th/20th and 2nd summer May 8th/23rd; Wells adult March 17th; Holkham second winter March 6th; Scolt adult Dec 17th; Brancaster adult Dec 10th/11th; Hunstanton-Holme adult Feb 1st-3rd, first winter March 2nd, Feb 5th and other sightings on Nov 19th, 27th and 28th and Dec 11th; Heacham adult Dec 24th and Ousemouth March 1st.

Hybrid Glaucous Gull × Herring Gulls at King's Lynn docks 1st winter Jan 30th and again at Blackborough End Tip Feb 24th. A 2nd winter hybrid at Heacham Dec 24th into 1989.

Kittiwake: 1,300 Lynn Point during NW gale and sleet Feb 29th, over 1,000 spiralling up and flying inland. Largest autumn movement: 3,000 west Titchwell Nov 20th during single hour.

Inland sightings of 4 Welney Feb 29th and one ENE Weeting Heath March 12th.



Caspian Tern: An early bird at Breydon April 29th (INS) followed by 2 at Hickling June 18th (ADB JSH FR KS *et al*).

Lesser Crested Tern: Arnold's Marsh Cley Aug 26th (AJ RLM CI) and Titchwell Sept 3rd (MB AL MS MLW). A Lesser Crested Tern summered on the Farnes also visiting coasts of Northumberland and Tyne and Wear. Presumably the Norfolk sightings relate to this bird.

Sandwich Tern: Extreme dates March 20th (Cley) and Nov 19th (Titchwell). Bred at Blakeney Point 1,000 pairs. At Scolt 2,775 pairs produced 1,200 young — similar number of young lost by Fox predation along with 60 adult birds.

Roseate Tern: Noted at Cley/Blakeney Point Aug 28th (PG) where 4 Sept 3rd/4th (SCJ RQS) including a juvenile. This party found in a mixed flock of Terns comprising 60 Sandwich, 20 Common, 1 Arctic and 2 Black Terns.

Common Tern: Observed between April 3rd (Thornham) and Nov 4th (Cley). A total of 718 pairs bred in the county, the colony at Breydon on platforms again having good success with 82 pairs. Other major sites included Blakeney Point 200 pairs, Scolt 208 and Snettisham 90.

Arctic Tern: Extreme dates April 19th (Thornham) and Oct 22nd (Snettisham). Only a handful of spring migrants noted at Hardley Flood, Cley, Thornham Point, Holme (14) April 30th, Snettisham and Lakenheath Washes.

Autumn numbers small (89 individuals), maximum parties being 6 Weybourne Aug 28th: 12 Blakeney Point Aug 18th, 12 Oct 15th and 8 Oct 16th together with 12 Thornham Point Aug 29th.

A few mid-summer birds (1-3) in June/July at Breydon, Cromer and Wells. Breeding occurred at Blakeney Point (4-6 pairs) and Scolt (2 pairs) — one successful.

Little Tern: An extremely early record at Yarmouth of 2 March 24th, but main arrival not until April 16th (Scolt) and 17th (Brancaster). Very late birds at Ousemouth Oct 7th, Wells Oct 8th and Blakeney Point until Nov 13th.

A minimum county total of 561 breeding pairs rearing at least 380 young.

Inland sightings: Welney May 8th, Pentney GP May 11th, May 16th/17th and June 8th; also 2 Flitcham May 16th.

Whiskered Tern: A juvenile at Welney Oct 17th and 21st-23rd (JBK RN LB *et al*). The fifteenth county record. Additional 1987: Yarmouth June 27th (MRF AR) and Titchwell on 28th (WAD); perhaps the Pentney bird.

Black Tern: Extreme dates April 23rd (Holme, Titchwell) and Oct 19th (Holme). Widespread spring passage when recorded at 28 sites, the main movement commencing around May 7th/8th when largest parties were of 21 Breydon, 26 Hickling, 20 Hardley Flood, 12 Weybourne, 26 Cley/Salthouse, 12 Holkham, 21 Holme, 10 Lynn Point, 10 Welney and 10 Lyng GP. A further late influx (1-5 birds) occurred at 6 sites in mid-June.

Very few in autumn apart from Sept 7th/8th when up to 22 at Cley/Blakeney Point.

White-winged Black Tern: A juvenile at Gillingham Aug 19th-22nd (AR RW *et al*) followed by one perhaps the same at Breydon Aug 24th (PRA).

Guillemot: Inland: Welney March 2nd.

Black Guillemot: Weybourne one in summer plumage May 7th; Paston and then Cley Nov 13th.

Little Auk: A notable wreck following gales of the early year with 8 dead and 2 inland between Jan 10th and April 4th, but only 4 singles offshore Feb 28th-March 6th.

In autumn birds offshore 27 dates from Oct 13th. Double-figure counts as follows; Cley 17 Oct 24th; Paston 39 on 30th and same day Cley 80, Weybourne 12 and Blakeney Point 10: Cley 14 Nov 2nd and 40 east/2 west off Weybourne the next day; Yarmouth 26 north 19th; Cromer Pier 20 on 20th when the same number off Titchwell and 19 at both Cley and Paston; Holme 21 Nov 21st and Cley 25 Dec 3rd. Last coastal bird oiled and stranded at Morston Dec 20th.

Singles on fresh-water at Cley Oct 29th; Buckenham Ferry Oct 31st and Horsey Mere Nov 2nd-11th. Corpses at Overstrand Nov 2nd and inland at Wreningham on 18th.

Puffin: Eighteen coastal records of 1-3 Feb/March and Sept to Dec including 5 dead ones in March.

Collared Dove: Good numbers at Hoveton grain depot: 100 June 27th, 120 in Oct and 160 by mid-Dec. Shouldham 280 Dec 12th.

Turtle Dove: Very unusual record from Tatterset Feb 26th (AB). First of spring Filby April 9th followed by a more general arrival from 17th. Last Stiffkey Oct 25th. No large counts received, neither of spring passage nor of post-breeding gatherings.

Ring-necked Parakeet: 1-2 at Cley, Holkham Park, North Walsham, Salthouse, Wells, Weybourne and Winterton.

Barn Owl: Recorded at over 150 localities.

Little Owl: Recorded at over 70 localities.

Long-eared Owl: Breeding records from 10 sites and winter records from another 10 with largest roosts of 4 at North Barsham Feb/March, 7 at Egmere Nov and 6 at a Fenland site and also Old Buckenham both Dec.

Coastal migrants: Winterton 2 March 10th; Yarmouth one and Winterton 2 April 10th; Blakeney Point May 14th; Holme Oct 12th; Weybourne 18th; Blakeney Point one and Holme 2 on 25th and single at Holme Oct 28th/29th; also singles at latter site Nov 11th and 15th.

Short-eared Owl: Two pairs bred at Wolferton. Numbers relatively low at beginning of year, but an excellent autumn with total of 21 birds seen arriving off sea between Oct 11th and Nov 5th (9 of these Oct 24th when 4 in 45 mins at Blakeney Point).

Autumn passage reflected high wintering population especially in Halvergate Marshes where up to 20 by the year-end. Elsewhere widespread observations with peaks of 8 Snettisham Nov 5th and 6 Burnham Deepdale/Scolt area Oct 21st.

Nightjar: A breckland survey (to be completed 1989) produced a total of 187-211 churring birds of which 87-97 in Norfolk (RSPB). A substantial increase since 1981 BTO survey.

Elsewhere churring birds at Buxton Heath, Cawston Heath, Leziate, Roydon Common (6 — first recorded on the early date of April 28th), Salthouse (6), Winterton (3) and Wolferton (5). One hawking insects under illuminated Dun Cow Inn sign in Salthouse village July 12th. An autumn migrant Little Eye Salthouse Sept 5th.

Swift: Earliest records Holme April 22nd and Winterton April 25th. A partial albino with white rump and underparts Yarmouth May 15th/16th, presumably same bird as seen there May 1985 and possibly same bird Cley May 18th. A Paston 1,000 moving west July 31st. Very late stragglers Paston Nov 12th and Little Plumstead and Cromer GC Nov 13th.

Alpine Swift: A very early migrant Brancaster Staithe March 19th (DWH).

Additional 1987: Old Hunstanton and Holme April 30th (MLW).

Kingfisher: Recorded at 84 localities.

Bee-eater: Paston an adult Aug 14th (MF) and Holme Aug 16th (DAP). A juvenile at Salthouse, Cley and Blakeney Point Sept 3rd and then, remarkably, single juveniles next day at Waxham, Paston, West Runton, Cley, Titchwell, Holme, Snettisham, Wolferton and West Winch — probably two individuals involved.

Hoopoe: An above average number of records: Northrepps (in observer's garden) April 10th, Burnham Overy Staithe April 15th-18th, West Bilney April 18th, Holme April 21st-23rd, Titchwell May 5th, Martham Broad May 9th, Holme Aug 28th, Aldby Oct 2nd, Winterton Oct 13th and Beeston Common Oct 22nd-29th.

Additional 1984: Great Hockham 2 April 30th.

Wryneck; A similar number of spring and autumn records. *Spring:* Holkham Meals April 17th, Burnham Overy Dunes and Winterton April 20th, Saxlingham Nethergate April 22nd/23rd, Hickling May 1st/2nd, Burnham Deepdale May 2nd-5th (calling frequently), Caister May 5th, How Hill May 9th and Salthouse May 14th/15th.

Autumn: Cockthorpe Sept 9th, Cley Sept 12th, Paston Sept 13th/14th, Tottenhill Sept 15th-21st, Beeston Sept 20th, Hunstanton GC Sept 26th, Wickmere Sept (no date but photograph produced) and Waxham Oct 26th.

Great Spotted Woodpecker: A continental migrant in off the sea landed exhausted on Yarmouth beach Oct 11th.

Short-toed Lark: Blakeney Point one briefly Oct 1st (GED SCJ *et al*). The twelfth county record.

Woodlark: At Sandringham Warren 2 (one singing) March 2nd. Two migrants Burnham Overy dunes March 20th, one also in song. In whole of Brecks total of 43 singing males including 20 in Norfolk. The results of a two-year Brecks study will appear in the 1989 NBR.

Autumn migrants Holkham Meals Oct 23rd and Cley Nov 5th.

Shorelark: The major national decline in numbers is reflected in Norfolk. At Thornham

Point 5 from beginning of year until March 28th, then decreased to 4; 3 still present May 1st. Elsewhere 5 Blakeney Point Jan 13th-20th, 3 there April 15th-17th and one April 23rd. At Holme 4 Jan 26th and one Snettisham April 1st-7th.

Only 5 records of singles in second winter period. Cley Oct 12th, Holme Oct 16th, Blakeney Point Oct 21st and Nov 13th, and Titchwell Nov 23rd.

Sand Martin: Earliest record Weybourne March 22nd. Fortunately appears to be increasing in numbers. Breeding pairs included the following: Lyng Easthaugh 300, Swanton Morley 250, Tottenhill 250, Strumpshaw 240 and Colney 120 (an increase from 17 in three years). In the Nar Valley ringing activities showed only a poor breeding season with a low ratio of juveniles to adults.

Swallow: Extreme dates March 20th (Holme) and Nov 12th (Waxham).

House Martin: Recorded between March 29th (Yarmouth) and Nov 20th (Stalham).

Richard's Pipit: A notable October influx: Waxham 27th/28th, Weybourne 2 2nd, 3 3rd, 7 4th and then singles 5th-9th, 15th and 18th, Salthouse 3 11th and 15th, 4 18th, 3 19th, 2 20th and one 21st, Blakeney Point 1st and 20th, Wells (East Hills) 15th, Burnham Norton 2 19th, Holme 1st and 12th/13th and Snettisham 2 18th and Welney 5th-9th.

Tawny Pipit: Singles Blakeney Point June 12th (JR *et al*) and Weybourne Oct 23rd (KBS).

Olive-backed Pipit: Stiffkey, one in typically wooded habitat Oct 13th (GDE MJE *et al*). The sixth county record.

Tree Pipit: Blakeney Point 2 late migrants Oct 16th.

Red-throated Pipit: Blakeney Point one May 15th, 2 the next day and one on 17th. Possibly 3 birds in total. One in song flight on 15th/16th (NMB GED MF TK *et al*).

Rock Pipit: Birds of Scandinavian race *littoralis* recorded Salthouse March 19th, 5 at Cley also March 19th, 4 20th and one 26th; also one Breydon April 9th.

Water Pipit: No records received in first 2 months of year. Spring passage: Lyng Easthaugh April 12th, Strumpshaw March 5th-17th, 3 March 19th and April 16th. Weybourne 2 March 6th-8th and 2 March 19th, Cley March 19th and Snettisham March 25th.

In second winter period Surlingham Church marsh singles 8 dates Dec with 2 on 25th/30th, Strumpshaw Nov 23rd/24th, Cantley 4+ Dec 4th, Horsey Oct 27th, Brancaster Dec 8th and Titchwell Oct 29th.

Yellow Wagtail: Earliest Cley April 1st. Flocks of 100 each at Cley April 17th, Holme and Snettisham April 29th; also 80 Waxham April 18th.

Latest: Hardley Flood Oct 25th and 2 Heacham Nov 6th.

Blue-headed Wagtail: Total of at least 30 on spring passage April 17th-May 17th including 3 Waxham April 18th and 3 Salthouse May 1st/2nd. Near Feltwell a male observed several dates late June apparently paired with a normal female Yellow Wagtail. Also singles Wissington BF July 30th and Burgh Castle Aug 14th.

Grey-headed Wagtail: A total of 10 males of this distinctive race: Cley on the early date of April 17th/18th, then following May occurrences: Breydon 11th, Caister 18th, Weybourne 2 13th and one 24th, Salthouse 14th-16th, Blakeney Point 7th and another 15th and Thornham 15th/16th.

Grey Wagtail: Bred at minimum of 10 sites: Brandon Bridge, Buckenham Mill, Ebridge, Foulden, Lyng Bridge, Marlingford, Narborough, St. Helen's Well, Thetford and West Acre, also present in breeding season at Briggate Mill, Keswick Mill and Norwich (New Mills).

Pied Wagtail: At Whitlingham Marsh roost 60 Sept 6th increasing to 690 Oct 5th, 500 Oct 12th and then rapid decrease to 150.

White Wagtail: Notable spring passage April 1st-May 5th including 9 Brancaster April 20th, a highly unusual concentration of 26 on Cley Eye field next day and 8 Thornham Point April 22nd. One also at latter locality June 14th.

Waxwing: Towards the end of Oct parties began arriving all down the east coast of Scotland and England from Shetland to Kent. The vanguard reached Burnham Market Oct 22nd followed by 20 at Hunstanton 23rd, Wells 24th, Gorleston and Morston 25th and Holme 26th. At the month-end up to 45 were watched at Cley and Wiveton, 21 Salthouse Heath, 30 at Warham, 42 at Wells and 46 at Burnham Deepdale.

Daily observations at Holme included 32 short-stayers Oct 30th followed by 100 next day (including 80 hurrying westwards above the dunes), 65 Nov 3rd increasing to 150 to 200 near the church on 4th but reducing to 80 on 5th. The majority then departed, but 25 lingered on roadside hawthorns; 2 met an untimely end striking house windows.

At nearby Hunstanton 20 arrived Oct 30th and the following day 23 sped south-west along the cliff edge followed by 25 more in the town Nov 3rd briefly taking rose-hips and cotoneaster berries before heading eastward. Twenty arrived Nov 4th when 80 were at Snettisham. Warham Green attracted 26 Oct 31st when 42 at Wells.

King's Lynn (Gaywood) held up to 18 between Nov 1st and 23rd. But in the Fens at this time only a single recorded: at Downham Market. Likewise the only Breck report was of 2 in Thetford. In East Norfolk many observers headed for Sutton where up to 30 could be watched gorging on berries and drinking at the adjacent village pond between Nov 4th and 10th. All apparently moved to Catfield where up to 55 present until Nov 26th. In addition 120 noted at Burgh Castle and 40 at Bradwell Nov 10th and 24 visited

Stone Curlews in the Norfolk Brecks have declined to little more than 30 pairs. This Little Ringed Plover's nest in Breckland was in a carrot field.

Norfolk's main Red Deer herd is maintained in Thetford Forest. The tiny Muntjac, a recent addition to the county mammal list, continues to thrive.

Cantley on 20th. Elsewhere 20 at Attleborough Nov 10th.

Observations received from Acle Bridge, Attleborough, Aylsham, Blakeney, Blakeney Point, Bradwell, Brancaster, Brancaster Staithe, Brundall, Burgh Castle, Burnham Deepdale, Burnham Market, Burnham Overy, Caister, Cantley, Catfield, Cley, Corpusty, Cromer, Docking, Downham Market, East Runton, Eaton, Ebridge Mill, Egmere, Elsing, Felbrigg, Field Dalling, Foulden, Gaywood, Gorleston, Hales, Heacham, Hellesdon, Hickling, Holkham Meals, Holme, Horning, Hunstanton, King's Lynn, Little Ryburgh, Martham, Mill Street, Morston, Mousehold Heath, Neatishead, North Creake, Northrepps, Norwich, Old Costessey, Salthouse Heath, Salthouse, Sheringham, Snettisham, Strumpshaw, Sutton, Thetford, Thornham, Titchwell, Thorpe St. Andrew, Tunstead, Warham Green, Wells, Welney, Weybourne, Wicklewood, Winterton, Wiveton, Yarmouth and Yelverton.

Although small by comparison with the huge invasion of 1965 (when 1,000 to 2,000 appeared in the county) this irruption was most welcome to birders and photographers alike. In addition it gave pleasure to a much wider audience. Earlier influxes of these delightful visitors were recorded in 1970 and 1974 when Norfolk totals of 870 and 500 respectively were attained. Peak numbers were present between the last week of Oct and late Nov. At the height of the movement county daily totals were as follows:

Oct	30	31	1	2	3	4	5	6	10	11	Nov
	200	*315*	*87*	*38*	*120*	*285*	*182*	*96*	*203*	*94*	

Throughout Dec scattered parties and singles appeared at Blakeney Point (2), Brancaster Staithe, Brundall, Catfield, Cley, Foulden (8), Hales, Holme (the month total of 46 included flock of 31), King's Lynn (3), Snettisham (2), Tunstead, Wells, (10) and Welney. Few remained more than a day.

Black-bellied Dipper: A well-watched individual at Lyng from Nov 21st into 1989, also one at Bure Valley trout lakes Dec 2nd and at Ketteringham Mill Dec 4th.

Robin: Blakeney Point: A notable fall of migrants Oct 16th, birds arriving throughout the day.

Thrush Nightingale: Blakeney Point a male May 15th-18th (GED SCJ *et al*).Fortunately it responded instantly by singing to a tape which simplified identification. The third county record.

Nightingale: Several spring coastal migrants recorded: Waxham April 18th, Weybourne April 17th and May 13th, Burnham Overy (Gun Hill) May 17th and Holme April 23rd and May 22nd.

Bluethroat: A male of the white-spotted form at Waxham April 17th (GMC MR JSH *et al*). Only the fourth identified county record and the first since 1954. More typically birds of the red-spotted Scandinavian form in May: Winterton 15th, Cley 16th and 18th, Blakeney Point 3 16th with one remaining next day, Burnham Overy (Gun Hill) 16th and Holme 14th-16th with another 18th.

Four autumn records, the largest number since 1976: Holkham Meals Sept 14th/15th, Blakeney Point Sept 17th, Weybourne first-winter male (trapped) Oct 20th-25th and Snettisham Oct 21st.

Black Redstart: Single winter record: Paston Feb 6th/7th. Spring passage from March 16th (Heacham) with main movement of over 30 birds April 1st-3rd round whole coast and including 5 Heacham-Hunstanton and one inland at Colney GP. In breeding season 6 singing males at Yarmouth/Gorleston, but only 2 pairs definitely bred; elsewhere pairs bred at King's Lynn BF, Norwich, Thetford and Wissington BF. Autumn passage mainly second half of Oct with maximum of at least 10 Yarmouth 19th/20th.

Redstart: Recorded April 17th (Paston) to Oct 25th (Yarmouth). Reported at 15 localities in Stanford 'Battle Area' in Brecks in breeding season.

Whinchat: Breeding noted in Brecks at Grime's Graves, Smoker's Hole, Tommy's Belt and Tottington. Autumn passage concentrations of 19 at Wells (East Hills) Sept 7th and 15 in small stubble field at Waxham Sept 17th. Last noted Snettisham Oct 27th.

Stonechat: In east Norfolk 6 pairs bred with another pair also present.

Wheatear: First recorded March 17th (Morston). Breeding again proved at Bacton. Latest records included singles Choseley and Ten-mile Bank Nov 5th, Holkham Nov 6th and Snettisham Nov 5th-13th.

Pied Wheatear: Blakeney Point female Oct 16th (APC BEC SAS *et al*). The fourth county record.

Ring Ouzel: Widespread and heavy spring passage March 27th (Weybourne) to May 20th (Holme) with majority of records in second half of April. For example on April 16th at least 35 on north Norfolk coast including 20 at Holme. At Holkham Park maximum of 16 during the month. Inland sightings in April included Saham Hills 8th/9th, Pentney GP 1-2 15th-28th, Sparham 19th, Strumpshaw 3 24th and one 25th, Norwich 3 24th and one 26th/27th, Little Melton 3 27th, How Hill 2 28th, Welney 27th to 29th, Blickling 2 29th and Stowbridge 30th.

In autumn one Holme Sept 9th then again many records Oct 1st to Nov 6th (Weybourne and Sea Palling) with maxima of 8 Holkham Meals Oct 12th and 7-8 Blakeney Point Oct 16th. Singles inland at Welney and Norwich Oct 13th.

Fieldfare: An albino Colney GP March 26th. Records of singles in June at Holkham Meals 2nd, Flitcham 9th (injured), Blakeney Point and St. Helen's Well 11th and Holme 24th. Early autumn arivals Holme Aug 29th and Weybourne Sept 6th.

Redwing: A leucistic bird Hoe Common March 20th. Late migrants Paston May 17th and Thornham May 24th. First recorded in autumn at Northrepps Sept 13th. Thousands arriving with Song Thrushes and smaller numbers of Fieldfares all day Blakeney Point Oct 16th.

Mistle Thrush: Flock of 40 Taverham Aug 4th and 35 Tunstead Aug 30th. At least 3 migrants arriving off sea with other thrushes Blakeney Point Oct 19th.

Cetti's Warbler: Despite a mild winter a continued decline. Singing birds at Coldham Hall, Hickling, How Hill, Irstead, Ranworth 2, Rockland/Wheatfen 4, Salhouse, Strumpshaw 4 and Surlingham Broad. Elsewhere single males at Brancaster and Titchwell.

Grasshopper Warbler: Earliest Boughton Fen April 17th. Fleggburgh Common held 6

pairs and 10 pairs at Hickling. An autumn migrant at Paston Oct 1st.

Savi's Warbler: Hickling, up to 3 singing from May 21st. Surlingham Church Marsh one singing July 9th to 29th.

Sedge Warbler: Earliest Snettisham April 3rd.

Marsh Warbler: Weybourne, a first-winter bird trapped Aug 28th (MPT JW) and another Cromer GC Sept 17th-25th (SCV *et al*). The seventh and eighth county records.

Reed Warbler: Earliest Hardley Flood April 16th.

Great Reed Warbler: Cley June 5th to 24th (CJJ PL *et al*). The ninth county record.

Icterine Warbler: *Spring*: Blakeney Point May 12th and June 8th-11th. *Autumn*:Holkham Aug 7th and Sept 6th; Weybourne Sept 8th; Holme Sept 17th-19th; Stiffkey Sept 29th and Oct 12th-13th.

Subalpine Warbler: A first-summer female trapped at Weybourne April 30th (MPT JW *et al*) and a male Blakeney Point May 8th-11th (MSC AMS *et al*). The sixth and seventh county records.

Barred Warbler: Only two autumn records: Weybourne (trapped) Sept 6th and Wiveton Sept 17th.

Lesser Whitethroat: Blakeney Point 20 May 11th. Late autumn birds at Winterton Oct 16th, Brancaster Oct 21st and Holme Nov 20th.

Whitethroat: A late bird Weybourne Oct 15th.

Garden Warbler: Earliest Holme April 3rd and Cley next day. Late spring migrants Blakeney Point included 2 June 9th and 4 on 11th. October birds included Cley 20th, Weybourne 22nd, Yarmouth till 25th and Wells till 31st.

Blackcap: Wintering individuals widespread in first three months of year: Cley, Cromer (2), Holkham Meals 3, Holme 3, King's Lynn 2, North Walsham, Norwich 2, Swannington, Thetford, Thorpe St. Andrew and Wells. Ringing information, both in Britain and on the Continent, indicates our wintering birds come from the Central European breeding population, just north of the Alps in Austria and southern Germany.

Impressive October passage included 15 in single tree at Yarmouth Oct 13th. Nov/Dec records from Cley, North Creake, Norwich 2, West Raynham and West Walton 2.

Greenish Warbler: 1987: The Waxham bird still present Aug 28th (JA).

Arctic Warbler: Yarmouth Oct 1st-2nd (PRA *et al*). The eleventh county record.

Pallas's Warbler: Six October records: Scratby 25th (IRH), Weybourne (trapped) 26th (KE KBS), Cley Coastguards 22nd-23rd (NM *et al*), Wells (East Hills) 23rd-24th (SH

et al), Holme 20th with another 22nd-24th (NOA) and Heacham 30th (MW).

Yellow-browed Warbler: Anticyclonic weather in mid-Sept produced the first at Holkham West End Sept 17th joined by another next day. 3 more were in the county before the month-end and from Oct 1st records widespread. All observations are given:

Yarmouth Oct 1st, 2-3 on 2nd, 2 on 3rd with one remaining to 5th; a new one 12th-13th and 2 on 17th. Winterton Oct 5th. Waxham Sept 28th, Oct 2nd-3rd and 13th. Paston Oct 13th and 16th. Cromer Sept 22-23rd.

Weybourne Oct 2nd, 2 on 3rd, one 8th, 3 on 12th with one remaining to 13th and one 16th-18th. Salthouse Oct 9th. Walsey Hills 2 Oct 20th. Cley 2 Oct 12th. Blakeney Point Oct 2nd. Stiffkey 3 Oct 12th, 2 on 13th, one 14th and 3 on 15th. Wells (East Hills) Oct 3rd, 2 on 5th with further singles on 9th, 13th and 21st. Holkham Meals Sept 17th, 2 on 18th, Oct 3rd-4th, 3 on 5th, 4 on 8th-9th, 7 on 11th, a remarkable fall of 18+ on 12th, 10 on 13th, 11 on 15th, 10 on 16th, 3 on 18th-21st and 2 new arrivals 22nd-24th. Thornham Harbour Oct 16th. Titchwell 1-3 Oct 7th-16th. Holme Oct 1st, 3 on 2nd, 4 on 3rd but only one on 4th, another Oct 11th increasing to 2 on 12th/13th and Snettisham Oct 9th.

Inland at Pensthorpe (trapped) Sept 24th and East Winch Common Oct 14th. Considering its former scarcity this delightful species goes from strength to strength to produce the best year yet. Numbers difficult to assess but appear to involve minimum of 69 individuals.

Radde's Warbler: Four October records: Wells East Hills 15th-17th (BRS JRMcC DAH), Blakeney Point 16th (SCJ GED *et al*), Warham Green 23rd (SPH) and Holme 24th-25th

(CJC *et al*). The twelfth to fifteenth county records.

Bonelli's Warbler: Holme April 9th (DTP MJW) and Blakeney Point May 14th (GED PF NW *et al*). The sixth and seventh county records.

Wood Warbler: A good number of spring records with obvious migrants at Horsey May 10th, Waxham 2 May 8th and one on 10th, Paston April 17th, Weybourne April 30th, May 3rd and 14th, Cley (Walsey Hills) April 22nd, Blakeney Point May 7th, Holkham Meals April 19th and 30th, and Holme April 18th with 2 May 3rd.

A large number of singing males from inland sites or breeding habitat: Baconsthorpe Castle, Beacon Hill, Beeston, Cromer, Dersingham, Elsing, Felbrigg, Frog Hill (Stanford Battle Area), Horsey, Horsford, How Hill, Mousehold Heath, Ringstead, Roman Camp, Salthouse Heath, Sandringham Park, Sheringham (Pretty Corner), Snettisham (Ken Hill), Sprowston, Thorpe St. Andrew and Wayland Wood. Many were short-staying migrants; breeding was confirmed only from Sheringham (Pretty Corner) and Mousehold Heath.

Autumn reports unusually late: Holme Oct 12th-14th, Waxham Oct 13th and Weybourne Oct 15th-29th.

Chiffchaff: Recorded in first-winter period at Surlingham Jan 6th and 17th, Rockland Jan 30th, Cley Sewage Works Jan 30th to Feb 13th, Holkham Park Feb 8th and 16th, Holkham Meals up to 4 Jan/Feb, Old Hunstanton Jan 9th, King's Lynn Jan 1st-March 25th, Tottenhill Jan 1st and Wymondham Feb 18th/19th.

Abietinus-type birds reported at Yarmouth till Oct 25th (up to 5) and at Weybourne Nov 2nd till year-end.

Tristis-types at Waxham Oct 16th (trapped) and Wells Nov 22nd.

December birds at Rockland 3, Surlingham Church Marsh, Salthouse Heath, Holkham Meals, New Holkham, Burnham Mill, Brancaster, Titchwell 2, Downham Market and Beetley GP.

Willow Warbler: First West Acre March 27th. October records from Weybourne (trapped) on 12th, and Holkham Meals on 21st and 30th.

Goldcrest: Blakeney Point, a large fall of 200-300 Oct 16th.

Firecrest: All records in spring (March 22nd-May 14th) and autumn (Sept 7th-Nov 5th) passage periods. Spring sightings at Yarmouth, Winterton, Horsey, Waxham (up to 6), Paston, Felbrigg (2), Weybourne (4), Gramborough Hill, Walsey Hills (2), Blakeney Point (2), Wells (3), Holkham Meals, Brancaster, Holme (5), Welney, East Wretham and Norwich.

In autumn at Yarmouth (2), Scratby, Waxham (3), Bacton, Paston, Weybourne, Salthouse, Blakeney Point (2), Stiffkey, Wells (up to 4), Holkham Meals (2), Holme and Norwich (2).

(Figures in brackets represent spring/autumn totals).

Spotted Flycatcher: First Weybourne April 27th. October records at Yarmouth, Blickling and Wells where latest on 13th and 19th.

Red-breasted Flycatcher: Typical autumn records: Weybourne Sept 14th, Blakeney Point 2 Oct 2nd and Yarmouth Oct 17th-21st.

Pied Flycatcher: An interesting year combining a strong spring passage, but a small and noticeably late autumn movement.

In spring at Yarmouth 2 May 10th and one on 14th; Winterton April 16th and May 14th; Horsey May 10th; Waxham May 7th/8th and 12th; Felbrigg April 23rd; Blakeney Point singles April 30th, May 2nd and May 12th with 3 13th, 4 14th, 5 15th, 3 16th and one 17th, also June 9th; Holkham Meals April 30th, May 7th, 2 May 16th and peak of 10 May 17th; Thornham Point May 8th and Holme May 14th.

In autumn one Horsey July 21st; October observations at Yarmouth 3rd-5th and 21st; Stiffkey 14th and 16th; Holkham Meals 4 on 5th, 3 on 12th and one till 13th; Brancaster 13th-24th and Holme 13th.

Bearded Tit: Breeding records included Strumpshaw 6 pairs, Ranworth/Woodbastwick 15 pairs, How Hill 5 pairs, Hickling 20 pairs, Horsey 12 pairs, Cley, and King's Lynn BF 3 pairs. Post-breeding assembly of 62 — great majority juveniles — Cley July 5th.

Autumn dispersal again obvious and included 35 Burgh Castle Oct 10th, up to 15 Berney Oct/Nov, 10 Winterton Oct 5th 4 groups totalling 39 west Cley Oct 29th, 25 Wells Oct 11th, 58 Holme Oct 1st with several other parties of up to 45 during Oct and 25 King's Lynn BF Nov 27th.

Additional autumn records: Weybourne 4 arrived in off sea Oct 24th, Blakeney Point 2 Oct 2nd, Brancaster, Brancaster Staithe, Thornham Point, Snettisham, Tottenhill and Welney.

Golden Oriole: Spring migrants at Ridlington (heard) May 5th, Strumpshaw (heard) May 7th and Glandford June 1st. Summer occurrences included male Welney July 9th/10th and 31st with another there July 26th.

Isabelline Shrike: Horsey Gap Oct 26th (WRB). The third county record.

The Holkham 12th/13th Oct 1975 record has been re-considered by British Birds Rarities Committee as showing characters closest to the race *phoenicuroides*.

Red-backed Shrike: In the Brecks a well-publicised pair raised 3 young at Santon Downham.

In spring single migrants at Caister, Winterton, Hickling, Waxham, Weybourne, Blakeney Point, Thornham Point, Holme and Shereford May 8th-23rd.

In autumn migrants at Hickling, Northrepps, Cromer, Weybourne, Blakeney Point, Morston, Wells, Burnham Overy, Titchwell, Holme (2), Hunstanton GC and Snettisham Sept 4th-Oct 20th.

Great Grey Shrike: Single winter occurrence: Potter Heigham/Hickling Feb 6th/7th. In spring in same area April 1st and 11th and at Horsey/Waxham April 17th.

Noticeable arrival third week Oct with birds at Yarmouth 17th-19th, Winterton 19th and 24th, Waxham 22nd, Salthouse Heath 20th, Blakeney Point 19th, Holkham 12th and 21st/22nd and Heacham 18th; also one Salthouse Nov 24th.

Woodchat Shrike: Waxham female July 25th (RMP SCT).

1986: Titchwell Aug 10th (SRC DRC MPT *et al*).

Magpie: Roosting sites: Hickling 25+ Dec; Buxton Heath 81 Jan 31st, 116 Feb 6th and 150 Feb 20th; Holme 46 Dec; Roydon Common 82 Feb 14th, 71 Dec 10th and 40 Dec 18th and Old Buckenham Common 40 March 10th.

Hooded Crow: During Jan/Feb singles at Happisburgh and Roydon Common. Spring passage noted at 8 sites. Usually singles, but a party of 6 Winterton/Horsey March 20th. In Nov/Dec 1-2 at 10 localities.

Starling: Lynn Point flock of 2,000 July 27th contained a juvenile with striking buff/cinnamon plumage reminiscent of Rose-coloured Starling.

Brambling: In first-winter period only flocks reported were 30 Swaffham and 20 Beechamwell with latest April 28th (Shingham and Ormesby).

Large-scale arrival during October included 600-700 Blakeney Point on 16th followed by 60 Holme Hale and 150 Anmer in Dec.

Siskin: Winter flocks of up to 50 at Dersingham, Filby, Lenwade, Pentney, Ranworth, Santon Downham, Sparham, Strumpshaw, Sutton, Wells and West Acre, with 150 Thetford GC Jan 17th and 100 Stanford Nov 19th.

Passage counts included 60 north at Waxham and 42 north at Paston Sept 18th and 70+ west at Wells Oct 23rd.

Twite: Largest flocks recorded in second-winter period: 200 Wells Lodge Marsh, 300 Holkham Gap, 350 Burnham Norton and 700 in Brancaster harbour/Scolt Head area.

Largest flock in first-winter period 200 Blakeney Quay. Latest in spring Wells March 29th. Eastward passage at Weybourne Oct 3rd to Nov 12th peaked at 80 Oct 22nd.

This species is the only passerine regularly migrating eastwards along the north Norfolk coast in autumn. The Twite's breeding range in Europe is largely restricted to Britain and western Norway. Many of those nesting in the southern Pennines assemble in large over-wintering flocks on The Wash salt-marshes. 17,000 were estimated in Feb 1986, but less than half the number in the following winter when many of the population may have crossed the North Sea to winter in the Low Countries, together with birds from Norway (RSPB).

An inland record at Welney March 14th and at Wereham where 8 Jan 11th and 3 on 12th feeding on seeded sugar-beet.

Mealy Redpoll: Only record in first-winter period: Wells Feb 11th. Autumn/winter records; Weybourne single Nov 6th/8th and 7 Dec 21st; Brancaster Dec 10th; Titchwell 2 Nov 19th and single Dec 14th; Thornham 2 Dec 3rd, Pentney GP Dec and Binham 2 Dec 16th.

Lesser Redpoll: Among flocks reported: Titchwell 40 Nov, Pentney GP 60 Dec, Narford 45 Jan 17th and Binham 100 Dec 16th.

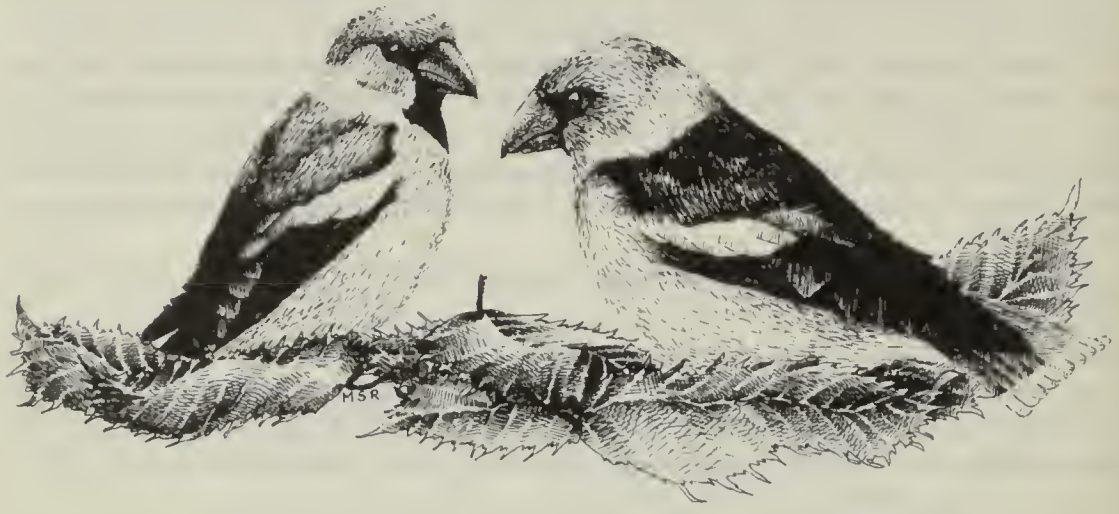
Common Crossbill: Most reports from Brecks (maxima 16 Santon Downham Aug 17th and 16 Thetford GC Sept 18th) and from Holkham Meals June to Oct (peaking at 23 June 23rd).

Elsewhere a scattering of records June to Nov with largest group 25 Kelling Heath June 17th; no other party exceeded 9 birds.

Hawfinch: Up to 16 present Jan at regular site in TF70 with peak of 14 Feb increasing to 40 in March. In April numbers declined to 7 by 17th. In May occasional sightings of a pair at the same locality suggested breeding may have occurred. Poor fruiting of the Hornbeams resulted in only a single bird (Nov 26th in second-winter period).

During first part of year birds continually present at Holkham Park with maximum of 25 March 12th. Other notable flocks included 15 Costessey mid-Jan, 15 Ringland Jan 10th and 32 East Wretham March 19th.

Breeding was only confirmed from single pairs at Kelling and Thorpe St. Andrew. Elsewhere 1-5 at Alderford Common, Beechamwell, Billingford, Cranworth, Elsing, Kelling Quags, Lenwade, Lynford, Narford, North Creake, Norwich, St. Helen's Well, Salthouse Heath, Sandringham, Santon Downham, Sheringham (Pretty Corner), South Wootton, Stiffkey, Swannington, Thetford Warren and Wayland Wood.



Lapland Bunting: Small numbers at regular coastal sites; Paston, Cromer, Weybourne, Salthouse, Cley, Blakeney Point, Stiffkey, Brancaster, Titchwell and Snettisham. Largest numbers as usual at Burnham Norton where peak of 40 Nov 26th. Latest spring bird: male Blakeney Point May 15th-17th.

First autumn return: Cley Sept 8th. Inland: Strumpshaw Jan 5th and Berney up to 7 till mid-March and again present from Oct 13th with maximum of 14 Nov 12th.

Snow Bunting: Largest flocks: In first-winter period: 120 Salthouse Jan 10th, 100 Holkham Gap Feb 1st, 150 Titchwell Feb 12th and 120 Thornham Point Jan 10th.

During second-winter period 350 Paston Nov 16th, 100 Cley Nov 13th, 200 Holkham gap Nov/Dec and 200 Holme Dec. Latest spring bird Holme April 24th; first autumn return 2 Blakeney Point Sept 17th.

Ortolan Bunting: Single record concerns a male Blakeney Point May 15th/16th.

Yellow-browed Bunting: 1975: The Holkham Meals individual observed Oct 19th (DJH JBK MP) has finally been accepted by BOU Records Committee. As such it pre-dates the Fair Isle bird of 1980 and becomes the first British record of this Asian vagrant.

A feature article will appear in the 1989 *NBR*.

Corn Bunting: Largest winter concentration: Marham 25 Feb 15th, Boughton 28 March 23rd and King's Lynn BF 10 Nov 8th. Additional autumn/winter records: Horsey, Weybourne, Stiffkey, Burnham Norton and Hilgay Fen. Observations in spring/summer from suitable breeding habitat many of which refer to singing males: Beechamwell, Berney, Boughton, Cart Gap Eccles, Choseley, Cockthorpe, Fincham, Happisburgh, Lakenheath Washes, Lynn Point, North Wootton, Sheringham/Weybourne, Shingham, Stoke Ferry and Wretton.

Indigo Bunting: Holkham Meals, a male Oct 21st to 30th (MJS JRW *et al*) still subject to official acceptance. Circumstantial evidence points strongly to it being of wild origin as it coincided neatly with British East coast arrivals of Cliff Swallow and Northern Waterthrush and followed hot on the heels of 2 East coast Red-eyed Vireos. This New World species has recently been promoted to Categary A of the British List.

CONTRIBUTORS TO THE BIRD REPORT

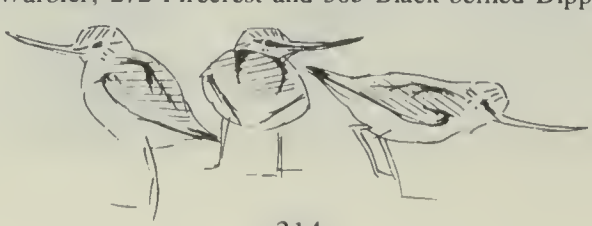
S. ABBOTT
R. ABERDEIN
P. R. ALLARD
G. ALLPORT
R. ANDREWS
C. APPLETON
J. R. APPLETON
T. ARCHER
R. J. ARNFIELD
M. ASKEW
M. AUSDEN
P. BAGETT
M. F. B. BAKER
R. C. BAKER
T. BAKER
P. R. BANHAM
S. BANKS
T. R. BARKER
M. J. BARRETT
M. A. BEEVERS
A. E. V. BELLARS
S. BETTS
D. BILCOCK
B. BISHOP
M. BLACKBURN
M. BLAIR
B. BLAND
A. BLOOMFIELD
E. F. BOOSEY
A. D. BOOTE
N. BOSTOCK
S. P. BOTHAM
B. BOUGHEN
T. E. BOULTON
C. G. R. BOWDEN
G. S. BOWEN
W. R. BRACKENRIDGE
MRS. M. A. BREWSTER
M. BRINDLE
MRS. D. S. BROWN
J. BROWN
M. BROWN
D. BRYANT
D. L. BUCKINGHAM
S. T. BUCKTON
A. L. BULL
MRS. R. M. BULL
M. BURROWS
P. BURROWS
J. F. BUTCHER
L. BUTLER
N. M. BUTLER
J. J. BUXTON
T. CALLAWAY
C. CAMPBELL
H. CARMICHAEL
M. S. CAVANAGH
G. CAVEY
P. CAWLEY
A. P. CHAMBERLIN
P. CHARLES
P. CHILLINGWORTH
J. G. CHIPPERFIELD
R. G. CLARK
MRS. M. R. CLARKE
P. R. CLARKE
B. E. CLEARY
P. CLEMENT
D. E. CLODD
S. COCHLAN
S. R. COLE
D. R. COLLINS
P. C. COOK
T. CORCORAN
K. COSSEY
G. M. CRESSWELL
C. J. CROSS
E. CROSS
W. A. DAVIDSON
T. E. DAVIES
T. R. DEAN
C. H. DOBBS
A. le F. DOBSON
P. J. DOLTON
C. DONNER
D. A. DORLING
O. G. DOUGLAS
D. J. DRAKE
A. P. DRIVER
S. P. DUDLEY
G. E. DUNMORE
K. R. DYE
G. M. S. EASY
J. C. EATON
G. D. ELLIOTT
DR. K. P. ELSBY
B. P. ENGLER
L. G. R. EVANS
R. J. EVANS
M. J. EVERETT
M. R. FAINT
R. FARNDON
F. FARROW
P. FEAKES
R. FILBY
P. FISHER
M. FISZER
M. R. FLACK
R. A. FOYSTER
R. J. FRANCIS
M. FREEMAN
S. J. M. GANTLETT
P. GEARY
MR. & MRS. J. GEESON
N. GIBBONS
K. GILLON
D. J. GIRLING
T. M. GIRLING
P. A. GLUTH
J. GOLDSMITH
C. GOMERSALL
P. GOODEN
A. GOODEY
C. GOSLING
M. C. GREEN
R. GRIBBLE
J. GUDGEON
A. HALE
M. HALE
P. HALE
J. HALL
N. J. HALLAM
J. S. HAMPSHIRE
B. HARDING
A. F. HARRIS
L. HARRIS
S. P. HARRIS
S. HARROP
R. B. HASTINGS
MR. & MRS. A. D. HAWKINS
M. I. HAYES
C. HEAD
P. J. HEATH
D. HERRIEVEN
L. HESP
P. F. HILL
D. A. HENSHILWOOD
J. HODKINSON
D. W. HOLDEN
D. J. HOLMAN
J. E. HOOK
D. HORSLEY
P. HOUGHTON
S. HOUGHTON
A. L. HOWES
I. R. HUNT

CONTRIBUTORS TO THE BIRD REPORT (continued)

R. HUNT
R. A. HUME
P. A. HYDE
R. A. IMAGE
T. INSKIPP
C. IVEY
B. W. JARVIS
P. A. JEFFERY
A. JENKINS
C. J. JENNINGS
R. JENNINGS
G. JESSUP
K. JOHNS
A. JOHNSON
K. JOHNSTON
P. JONES
S. C. JOYNER
P. KEARNEY
G. I. KELLY
L. KELLY
F. D. KELSEY
J. B. KEMP
T. P. KERRIDGE
DR. I. F. KEYMER
MRS. J. KEYMER
MRS. B. E. L. KIGHTLEY
C. R. KIGHTLEY
P. D. KIRBY
C. A. E. KIRTLAND
DR. P. G. KITCHENER
J. F. W. KNIFTON
C. R. KNIGHTS
MRS. R. J. KNIGHTS
C. D. KNOTT
D. KRAMER
C. J. LACEY
A. J. LAST
J. M LAST
DR. C. H. B. LAWFIELD
J. R. LAWSON
DR. R. M. LEANEY
P. LEE
D. LESTER
A. LEWIS
D. A. LEWIS
P. LEWIS
DR. J. LINES
S. E. LINSELL
A. LIVINGSTONE
P. LOCKWOOD
A. R. LOWE
B. J. MADDEN
J. D. MAGEE
J. MAKEPEACE
R. C. MANSFIELD
D. MAYES
R. McANULTY
J. R. McCALLUM
N. V. McCANCH
J. C. McCORMICK
R. McCURLEY
R. C. McINTYRE
S. C. McINTYRE
N. MEARS
H. MEDHURST
P. MILFORD
R. MILLINGTON
R. MONTEITH
B. MOORE
DR. D. H. MORGAN
R. L. MORGAN
P. A. J. MORRIS
E. T. MYERS
Natianal Trust
K. NAYLOR
R. NEALE
R. NELSON
M. NEWTON
Narfalk Yaung Naturalists
D. NORTH
D. J. ODELL
G. L. OLDHAM
D. C. ORR-EWING
M. OTSU
D. PALMER
J. C. PALMER
T. W. PALMER
P. PARKER
DR. D. T. PARKIN
R. M. PATIENT
MISS. S. E. PECK
R. PERKINS
DR. M. PETCH
P. E. PETTITT
DR. D. PILCH
N. PINDER
S. PLANT
D. A. POND
A. J. PRATER
R. PRESTON
A. RAE
J. L. RAINCOCK
M. H. RAINS
H. RAMSAY
M. S. READ
J. REED
R. P. RESTON
D. REVETT
J. REVETT
B. RICHARDS
D. I. RICHMOND
MRS. R. M. RICHMOND
A. RISEBOROUGH
K. RIVETT
F. A. ROBERTS
R. ROBINSON
M. E. S. ROONEY
R. S. P. B.
B. RUMSEY
D. H. RUSSELL
F. RUSSELL
M. D. RUSSELL
W. RUTHERFORD
D. SADLER
K. G. SAUL
MRS. D. SAUNT
M. J. SAUNT
C. SAYER
B. R. SCAMPION
M. J. SEAGO
A. SELF
J. R. SELF
K. B. SHEPHERD
D. SHOWLER
S. SILLETT
N. SILLS
R. Q. SKEEN
C. SMALL
I. N. SMITH
R. SOUTHWOOD
R. A. SPAIN
Stanfard Training Area Bird Graup
P. STEELE
M. STEWARD
S. A. STIRRUP
N. R. STOCKS
A. M. STODDART
L. C. STREET
MRS. S. STREET
W. J. SUTHERLAND
J. SWEENEY
D. TALKS
G. TAYLOR
DR. M. P. TAYLOR
Thetford Natural History Society
P. THOMAS
W. THROWER
R. TIDMAN
S. C. TILLEY
M. P. TODD
T. TOWNSEND
R. B. TOZER
J. TRIMINGHAM
H. VAUGHAN
A. E. VINE
R. B. VOTIER
S. C. VOTIER
C. WADE
R. WALDEN
R. J. WALKER
H. W. WALLIS
MRS. L. J. WALLIS
MRS. P. WALTON
F. A. WARDMAN
M. J. WARREN
A. M. WATERMAN
A. WEIR
J. E. M. WELSBY
I. WHITE
M. L. WHITE
S. WHITEFORD
J. R. WHITELEGG
Wildfawl & Wetlands Trust
N. WILLIAMS
J. R. WILLIAMSON
J. WILSON
B. WINGROVE
M. J. WOOD
R. C. & M. E. WYATT

Photographs: Shorelarks (*D. M. Cottridge*); Waxwing lower (*H. Hems*); Purple Sandpipers (*R. Jones*); Black Brant and Red-breasted Goose (*D. J. Kjaer*); Stone Curlews (both plates), Fieldfare and Little Ringed Plover (*C. R. Knights*); Glaucous Gull (*B. J. Madden*); Hawfinch, Great Grey Shrike, Nightjar, Red Deer, Muntjac and Hare (*R. Powley*); Whooper and Bewick's Swans (*M. Rains*); Waxwing upper, Little Auk, Hoopoe and Common Seals (*R. Tidman*).

Line Drawings: Inside Front Cover Marsh Harrier, 249 Marsh Harriers, 261 Wigeon, 282 Leach's Petrels, 288 Red Kite, 293 Little Stints and Curlew Sandpipers, 297 Mediterranean Gulls, 299 Caspian Terns and 300 White-winged Black Tern (*N. Arlott*); 304 Waxwings (*B. Bland*); 302 Hoopoe, (*D. Bryant*); 273 Hawfinch (*C. Donner*); 290 and 313 Hobbies (*R. Farndon*); 259 Little Tern (*P. Haddon*); 315 Roe Deer, 316 Fox, 317 Common Seal, 318 Grey Seal, 319 Fallow Deer, 323 Harvest Mice and 325 Red Squirrel (*J. Last*); 296 and 314 Terek Sandpiper (*J. R. McCallum*); 285 American Wigeon, 302 Bee-eater, 307 Subalpine Warbler, 308 Pallas's Warbler and Yellow-browed Warbler (*R. Millington*); 254 Stone Curlews, 280 Black-necked Grebes, 291 Stone Curlews and Little Ringed Plover, 294 Woodcock and 311 Crossbill (*R. Powley*); 281 Sooty Shearwater, 284 Brent Geese and Brant Goose, 287 Surf Scoter, 301 Nightjar and 312 Hawfinch (*M. Read*); 253 Waxwings, 260 Pintail and Bewick's Swans, 277 Swifts, 279 Black-tailed Godwits and 303 Shorelarks (*the late R. A. Richardson*) and 262 Wheatear, 268 Bluethroat, 269 Red-breasted Flycatcher, 270 Yellow-browed Warbler, 271 Pallas's Warbler, 272 Firecrest and 305 Black-bellied Dipper (*A. Stoddart*).



NORFOLK MAMMAL REPORT 1988

Editorial

The Editor is pleased to present the 33rd Norfolk Mammal Report.

The biggest mammal story of the year, eclipsing in its implications anything that has occurred since these reports began, was the coastal catastrophe which overtook our Common Seals. Coming as it did at the end of the summer it held top news value and neatly slipped into place in the succession of disasters that continue preoccupying our nation. Are we developing a ghoulish delight in picking over the latest tragedy, indignation fuelled by charge and counter-charge, statement and denial, until interest flags and the next horror comes along to take precedence?

Seal news is now stale news and reports even now as we write that mid-summer deaths are being recorded merit minimal mentions. The greater tragedy is that the popular sympathy and genuine desire to help prevailing at the height of the disaster has transferred itself to other causes. Who can say which of the many should have priority? Is any order

seemly or appropriate? Surely, good will has no finite bounds and expands to embrace each cause as it comes along and support it through to some resolution if that is, in fact, possible.

A small band of workers has been warning us of the failing health of the sea and its inhabitants. Their continuing calls for prevention rather than the alleviation of symptoms must not be allowed to fade from the public ear.

Removing the overlays, we remind ourselves that these reports are statements of facts so far as they are known and we are indebted to two authorities for providing us with notes on seals for 1988. Bernie McConnell from the Sea Mammal Research Unit has been involved in seal research along the north coast of Norfolk and his report follows this editorial. Percy Trett has followed the fortunes of the seals of the east coast for many years and his reports are usually summarised in the classified notes. This year he has been invited to submit an extended report to stand in its own right and it seems appropriate for the two to be together.

A gap in our published data we have been hoping to fill for many years is the history of deer in our county and we are delighted to include David Henshilwood's feature article on Norfolk Deer parks.

We also welcome Bill Flynn's expansion on the usually brief item in the classified notes with his comments on the current wild deer situation and Dr. Morris Gosling adds what may be the final paragraph on the rise and fall of the Coypu in this country.

This plethora of specialised comments means that the classified notes must be briefer than usual. Fewer anecdotes and strange tales are told, but all the information submitted is stored on files and is gratefully acknowledged. Apologies for any omissions from the list of contributors are offered. Any such are entirely accidental and wholely the responsibility of the Editor.

Thanks are expressed to all our contributors including John Last whose ever-increasing pictorial skill continues to enliven our pages.

Submission for the 1989 Report should be addressed to Rex Hancy, Ardea, 124 Fakenham Road, Taverham, Norwich NR8 6QH, *if possible by the end of January 1990*. Telephone calls can be made on Norwich (0603) 860042.

The Common Seal Disaster

Bernie McConnell, Sea Mammal Research Unit, Cambridge.

In April 1988 the first signs of what was later to be termed Phocine Distemper Virus epidemic was observed in Common Seals in the Kattegat. Abnormally high numbers of abortions were recorded and adult seals were seen to suffer from respiratory distress and discharge from the nose and mouth. Subsequently, large numbers of Common Seals were washed up dead on beaches.

Over the next few months the disease spread down the German and Dutch seaboard and in July 1988 the first signs of the disease were observed in seals at Blakeney Point and in the Wash. Over the next 6 months over 1,300 Common Seal bodies were reported between Grimsby to Harwich. This figure almost certainly underestimates true mortality since it is unlikely that all the dead seals were washed ashore and recorded.

At Blakeney Point a joint programme with the National Trust and the Sea Mammal Research Unit was established to collect dead seal bodies to establish cause of death and measure the levels of the mercury and Polychlorinated-biphenols (PCBs). Live seals showing symptoms of the disease had small, numbered tags glued to their fur to give an indication of where, and how many, bodies would be subsequently discovered. Also, a radio telemetry programme was established to monitor the haulout behaviour of seals at Blakeney Point. Four, apparently healthy, seals were fitted with small VHF transmitters and automatic receiving stations were established at Morston and Hunstanton.

Aerial and land-based surveys of the Wash and Blakeney Point suggest that mortality in this area may have been as high as 60 percent, bringing the current Common Seal population size for this area down to around 2,500.

The disease spread northwards from the Wash up to Orkney, around the West coast of Scotland and into Strangford Lough, Northern Ireland. At least 17,000 Common seals in northwest European waters have died. The cause of the epidemic is still subject to much speculation. It has been suggested that the source of the virus may have been due to Common Seals coming into contact with Harp Seals in 1987 when an abnormally high number of Harp Seals were recorded in the North Sea. No link with pollution has yet been demonstrated.

Currently (April 1989), the epidemic appears to have halted. However there are fears that there may be a resurgence when Common Seals congregate to breed in June. Anyone seeing a dead or distressed Common Seal is asked to contact the Sea Mammal Research Unit (0223 311354).

East Coast Seals

Percy Trett

Scroby Island lying two and a half miles out in the North Sea off Yarmouth, normally has a resident population of about 120 Common Seals, (*Phoca vitulina*) and a visiting and breeding herd of between 420 and 900 Atlantic Grey Seals, (*Halichoerus grypus*). However, only a proportion of the herds are ever assembled on the bank itself. The number of Greys fluctuates considerably from year to year, a situation caused by the fact that the Island acts as an overspill area for the Farne Island herds. When the number on the Farnes reaches saturation point, late arriving and minor harem bulls and also non-breeding animals are excluded and travel down the North Sea and establish themselves on Scroby. Bulls, in the main, arrive before the cows. About a fortnight after the bulls appear, the cows are seen hauled out among them and normally about two to three days before Christmas the pups are dropped on to the beaches. This pupping continues until mid-January, followed by the weaning, mating and finally dispersal by the end of March.

During 1988 the North Sea herds of Common Seals have been greatly reduced in numbers by, it is thought, phocine distemper. Strangely, the seven dead seals that were removed and examined from Yarmouth area beaches did not die from that cause. One was injured and died from injuries most probably caused by propeller strike, one of pneumonia and the rest from septicaemia. It appears that their natural resistance had been reduced and they had succumbed to illnesses and minor cuts that would normally have proved non-fatal. What reduced their natural immunity is debatable. The fact remains that the resident herd of Common Seals on Scroby has been reduced to some thirty individuals and that the visiting herds of Grey Seals did not come to the Island nor to their alternative hauling-out beach at Horsey at all this year. I can only presume that due to the prevalent offshore winds of last summer, many dead seal bodies were washed out to sea, thus denying the authorities the opportunity of examining more carcasses.

It remains to be seen whether nature will be able to compensate by establishing immunity if the cause is viral. If the cause is chemical pollution, then we may be witnessing the erradication of seals on our coasts. Water and seabed sampling by three independent laboratories continues and so far their interim reports are disturbing.

Norfolk Deer Parks

D A Henshilwood

The three remaining deer parks in Norfolk, at Melton Constable, Houghton and Holkham are the last survivors of over forty historical deer parks in the county. Earliest references to deer parks are to be found in Domesday Book. Their development during the Saxon and Norman eras emphasises the importance which was attached to deer hunting. It is the Normans who are credited with the widespread introduction of the Fallow Deer and by the time Domesday Book was written Fallow stocked thirty-one English deer parks. In the ensuing history it was the Fallow Deer which was the species used to stock the newly created parks.

To anyone acquainted with the predominantly open, tree-dotted, landscapes of Norfolk's remaining parks, which form the setting for imposing architectural designs, a visit to Norfolk's earliest deer park at Costessey would reveal some unexpected features. Costessey in 1086 would have been a typical hunting park with large areas of forest enclosed within an encircling boundary wall. Modifying the landscape, or providing the setting for a country house did not enter into the plan. A Norman park was designed to provide an adequate supply of quarry species for the hunt, whilst protecting these species for the sole enjoyment of the landowner. Harsh penalties imposed for attempting to poach game emphasise the importance then attached to hunting.

Although Costessey was the first of Norfolk's deer parks, references to it are few and do not enable us to form a very clear picture of its history. Owned by a Saxon called Guert at the time of Edward the Confessor, the park was in the hands of Alan de Bretagne at the Conquest before passing to the Jerningham family. In common with many other deer parks, Costessey was disparked during the Civil War, but its importance lies in showing that Norfolk's historical deer parks were in existence nine hundred years ago.

Following Domesday Book there are scattered references to other early parks. Cawston and Old Buckenham existed by the late 1250's, while Whinborough and Winfarthing, established at the same time, were still in existence in 1581 and 1604 respectively. Little Ham and West Ham (1277) were in the hands of the Wodehouse family in 1561 and then passed to Sir Thomas Gaudy in 1585. Horsford, Hevingham, Earsham and Kenninghall, the last two established by the Dukes of Norfolk, are other early parks surviving to Elizabethan times.

The Elizabethan period saw a continuing development of the deer park, and a recognition of its value as a landscape feature as well as a hunting preserve. To a prosperous Elizabethan merchant or landowner, a deer park was an important component of his estate. The Pastons of Yarmouth established deer parks at Buxton and Oxnead, followed by the Townshends at Braconash and the Earl of Sussex at Attleborough. The older established park at Hevingham had become a royal park by 1610, together with further royal parks at Dereham and Shipdham. In the north of the county a group of parks at Baconsthorpe, Felbrigg and Thornage was in existence by 1581. The continuing development of deer parks in the county reflected a national trend. The Elizabethan period saw over seven hundred parks in existence throughout the country by 1580. It was a total which subsequent generations proved unable to equal.

What factors contributed to the decline of deer parks in the seventeenth century? Undoubtedly there were some Elizabethan landowners — encouraged by the prosperity of the age — who established parks and then found themselves unable to meet the expenses of running large estates. Much the most important factor, however, was the Civil War. The bitter conflict led to the destruction of deer parks on a large scale. Park walls were destroyed, the deer hunted for food and timber felled for ship building. Norfolk's oldest park at Costessey was a victim of this process and references to other Elizabethan parks either ceased or were interrupted by the Civil War. Not until the reign of Charles II did the creation of new parks repair some of the damage, leading to the resurgence of the deer park as a landscape feature in eighteenth and nineteenth century estates. The destruc-

tion wrought by the Civil War was to provide a foretaste of the problems of maintaining deer parks during national conflicts — problems which re-emerged as the twentieth century's major conflicts reduced further the number of viable parks.

The eighteenth century provides us with two of the best-known Norfolk parks: Houghton, established in 1722 and Holkham completed between 1735 and 1759. In area Holkham was one of the largest enclosures, its 790 acres exceeded only by Gunton where an 825 acre park was established in 1825. The expense involved in constructing deer park walls was often considerable. The nineteenth century wall of the present park at Holkham took over six years to build and is nearly nine miles long. Elmham and Kimberley were other newly created eighteenth century parks, while Blickling disparked some time after 1581 and enjoyed a resurgence in the nineteenth century. The concept of the royal deer park also continued into the nineteenth century when Sandringham was created in 1863. Scattered references reveal the presence of deer at a number of other estates including Weeting St. Mary, Rainham, Shadwell, North Elmham, Rackheath and Bayfield.

Despite this apparent increase in activity, the cumulative total of deer parks in the county was decreasing during the late eighteenth century. North Elmham had been disparked in 1844, followed by Rackheath in 1850 and Shadwell in 1867. By the time that Whitaker wrote his treatise *Deer Parks and Paddocks of England* in 1892 only eight parks were still in existence: the three contemporary surviving parks at Melton Constable, Houghton and Holkham together with Gunton, Blickling, Elmham, Kimberley and Sandringham. Two World Wars presented the owners of deer parks with sometimes intractable problems. In addition to direct destruction or disturbance through timber-felling or breaching park walls, the pressure from food production made the maintenance of large areas of grass increasingly difficult. The royal park at Sandringham was ploughed-up in World War II, as were parts of Holkham Park. Gunton's herd had dwindled to only six animals by 1938 and was extinct soon afterwards; Kimberley was a victim of the first World War and Blickling had ceased to exist after the second, its herd escaping through breaches in the walls. In the period following World War II agricultural self-sufficiently and increased production were the main objectives of many estates, mitigating against the re-establishment of historic deer parks.

We have seen that the establishment of Fallow Deer in Britain owed much to the Normans' enthusiasm for hunting and that Fallow were the principal species stocked in deer parks. At the time of Whitaker's survey, the largest herd of deer — 400 — was recorded at Holkham with 300 at Sandringham and over 200 at Houghton and Blickling. It would however be a mistake to assume that all the county's parks were stocked with Fallow. As long ago as the thirteenth century the park at Melton Constable was stocked with Red Deer and in 1892 herds of Red Deer were maintained at Sandringham (30) and Melton Constable (70) with a smaller group at Blickling. Shadwell maintained about 100 Red Deer until 1867 and although Houghton is now a Fallow Deer park it is clear that Red Deer were present there in the eighteenth century. The Royal huntsman, William Lowen, received the sum of £166.10*s*.0*d* for taking 100 Red Deer at Houghton and transferring some to Windsor. Such movements between parks were normal practice. Sandringham was stocked with Fallow from Windsor in 1863 whilst many of the Holkham Fallow Deer are descendants of a series of transfers from North Elmham. This park came into the ownership of the Coke family and the entire stock was moved to Holkham in 1844 following a series of earlier transfers from 1796 onwards. For many years after the disparking of North Elmham the vicar of the parish received a payment from Lord Leicester in lieu of the buck from the Elmham herd to which he was entitled to each year.

Of the three remaining deer parks Melton Constable has much the longest history and is the only deer park in the county to support Sika Deer. Introduced to Britain about 1860, the Sika was imported to Ireland by Viscount Powerscourt of Enniskerry, County Wicklow.

Around 1900 some animals were transferred to Melton Constable, joining the Red and Fallow Deer which Whitaker recorded in 1892. By 1949, Red, Sika and Fallow were all present in the same park. At the present time Melton Constable contains a total of some 300 deer divided almost equally between Red, Sika and the black variety of Fallow. The two herds of Fallow, at Holkham (700) and Houghton (1,000) also offer an instructive contrast. The Holkham herd has bred naturally, the Houghton herd has been selectively managed to promote the white form of the Fallow Deer, a few examples of which were present in 1949. The result of this selective management is the herd of all-white Fallow which forms such a striking feature of the park.

The maintainance of park deer in an enclosed environment has always required a certain amount of active management, aimed at maintaining a healthy breeding stock and a correctly balanced ratio between mature bucks, does and younger animals. Additional management may be required to maintain suitable grazing or to provide lying-up areas for newly-born fawns. At Holkham, for example, there is no tractor mowing of ground vegetation beneath the parkland trees during the summer months. Traditionally, the costs of managing the deer herd have been met by the sale of culled animals. More recently, the development of commercial deer farming and breeding has provided more opportunities for the three remaining deer parks to export live animals to other areas. Accurate counting of herds, checking of body weight and condition, experimental breeding with bucks introduced from other herds, the development of safe methods of capture and handling and improved veterinary care have all featured in the more active recent management of deer parks. With this recent resurgence of interest the future of Norfolk's remaining deer parks looks set to maintain the nine hundred-year tradition dating back to the county's first deer park at Costessey in 1086.

References

HARVEY. LT. COL. J. R. (1910) Deer Hunting in Norfolk. LEVER C (1977) The Naturalised animals of the British Isles. SHIRLEY E. (1867) Deer and Deer Parks. WHITAKER J. (1892) The Deer Parks and Paddocks of England. WHITEHEAD G. K. (1950) Deer and their Management.

CONTRIBUTORS TO THE MAMMAL REPORT

W. ALBRIGHT
M. ALDERTON
R. ANDREWS
M. D. ARMES
T. BAKER
M. J. BARRETT
I. BEGGS
J. BELL
L. A. BELL
S. BETTS
H. BLOOMFIELD
E. F. BOOSEY
M. A. BREWSTER
T. BROWN
A. L. & R. BULL
J. BUTCHER
L. BUTCHER
C. CAMPBELL
M. CAVANAGH
P. J. CAWLEY
M. CLARKE
Cley Bird Club
D. COKER
D. R. COWBURN
E. CROSS
T. C. DAVIES
D. DIX
D. & M. DORLING
M. G. DOUGLASS
G. DUNMORE
Eastern Counties Newspapers
C. EBBAGE
J. P. ELLERO
M. ELVIN
A. J. EVANS
R. & L. EVANS
H. FAIRHEAD
S. FAIRHEAD
F. & C. FARROW
M. FISZER
R. FRANCIS
J. E. GAFFNEY
J. & J. GEESON
N. GIBBONS
J. GOLDSMITH
DR. M. GOSLING
D. A. HENSHILWOOD
R. HADMAN
J. HAMPSHIRE
R. & B. HANCY
J. HARRIS
M. HASSALL
D. W. HOLDEN
M. HOWELL
E. HOYOS
A. HUNT
L. JACKLIN
D. J. J. JEFFERIES
D. & J. JERMANY
E. JERMANY
G. JESSUP
G. I. KELLY
J. B. KEMP
B. & J. KENWOOD
M. KETT
DR. I. & J. KEYMER
J. KINSLEY
S. J. S. LAKE
J. LAST
DR. R. M. LEANEY
J. LEE
D. LESTER
P. & J. LOVEWELL
S. LOVEWELL
M. & I. MACKEY
D. MAXEY
B. McCONNELL
M. MEACHEN
M. METCALF
E. MILNE-REDHEAD
Norfolk Ornithologists Association
D. PALMER
S. PASCOE
D. & P. PASHLEY
R., P. & E. POLS
D. POTTER
J. RAINCOCK
F. P. J. REYNOLDS
D. I. & R. M. RICHMOND
A. RIVETT
K. RIVETT
F. RUSSELL
M. D. RUSSELL
C. SALTER
C. SAYER
DR. D. E. SERGEANT
D. SHOWLER
C. J. SMALL
D. STAPLEFORD
J. STEWARD
E. TARRY
DR. P. TAYLOR
B. de TESSIER-PREVOST
Thetford Naturalists Society
P. TRETT
S. TYBUSKI
P. WEBB
R. WALBY
G. M. WANT
G. M. WEST
P. WHITTINGTON

Classified Notes

INSECTIVORA

Hedgehogs *Erinaceus europaeus* made the most of their opportunities during the autumn and were seen out and about in every month through to the following spring, evoking many an anxious 'phone call from worried householders. Coverage over the county from the distribution point of view was more widespread than in 1987 and contributors reported 'many' sightings. One's own notes in central Norfolk show fewer road casualties which gives concern that it indicates a fall in total numbers, which is yet to be confirmed. There is no fear that the Hedgehog is on the verge of becoming an endangered species. It is just that it could have become back-garden dependent.

No fears for *Talpa europaea*, the Mole! Even without the occasional cat catch and owl pellet evidence, its unseen presence is testified by innumerable heaps. Many in the Snettisham area but only one at home says our relieved correspondent!

Two Moles found in widely separated localities on the road surface showed scabbed, manged hind-parts, proof indeed that they are not without problems even in their underground retreats. A 'golden' variant from Costessey added a touch of colour to the lists.

Common Shrews *Sorex araneus* were found county-wide on doorsteps, presumably offered by cats, and down in the cellar at Hempnall. Perhaps they were hunting invertebrates there. 'Fewer' reported from Watton which may not reflect the total population, but does sum up the number of references to the Pigmy Shrew *Sorex minutus* which has a very sparse coverage on this year's map. It is represented on only 6 of our 10km. squares.

Strangely, as many squares were marked for the Water Shrew *Neomys fodiens* with the additional cheerful news from Breckland that in spite of the problems of suitable waters the species has been seen in many locations though the sites are not specified. Now Honeypot Wood is an official reserve they should have security of tenure at least. Several have been seen there. One unfortunate found running in a tight circle was examined and found to be wounded on the side of the head. Not surprisingly it died 4 hours later.

LAGOMORPHA

The story of both our lagomorphs is somewhat confused. The rise and fall of the Rabbit *Oryctolagus cuniculus* in different parts of the county reflects both the relative degrees of ability to survive the forms of myxomatosis now with us and the efficiency of other control measures. A significant figure is quoted from Scolt Head where the disease caused a drop in numbers of 80%. The question is, how long will the remaining 20% take to restore the colony to its previous strength?

Hare shoots have been suspended, temporarily or permanently, in some parts of the county, so relieving the pressure on the species in that respect. Large bags from Hare-favoured corners for winter congregation are still reported.

At Holme the Hares *Lepus capensis* were frequently found grazing the salt-marshes. More were seen there than on arable fields. Of the 3 seen by the dunes March 20th, one had clearly been in the water. Bird-watchers at Cley in late September were astonished to see a Hare actually in the water swimming out to sea. It was estimated to have continued for 60 to 70 yards before turning back to shore. A heavy swell was running and the tiring animal took five attempts before it could feel dry land under its feet again.

RODENTIA

Confirmed Red Squirrel *Sciurus vulgaris* reports are all from Thetford Forest. Reports on the Grey Squirrel *Sciurus carolinensis* suggest that while the few pockets of unoccupied suitable territory are being filled, the general population is settling down to its own natural level. "Common but not increasing" says a Sparham correspondent and that seems to sum up the situation. There are so many seen on such a regular basis that they will soon be ignored by recorders! Their destructive tendency has included taking house sparrows from under roof tiles.

It was Voles that nipped leaf and flower buds from the clematis at Thornham. Both Bank voles *Clethrionomys glareolus* and Short-tailed field voles *Microtus agrestis* seemed to be in good numbers in suitable habitat, a proviso so necessary to restate.

Cheerful news of the Water Vole *Arvicola terrestris* which continues to restock suitable waterways. In Old Hunstanton Park two were seen taking underwater food in an ornamental pond and coming up for air through the weed "like soldiers in camouflage." An old colony at Snettisham has gone and few were seen this year on the Sweet Briar Meadows at Norwich, but over the county as a whole more were reported.

Easily the most widely reported small rodent is the Wood Mouse *Apodemus sylvaticus* which in spite of its name is frequently found by habitations, eating garden berries, taking food put out for birds, using bird's nest boxes and generally taking as much advantage as it can, even appearing to thrive on poisoned wheat for several weeks until finally succumbing.

The Yellow-necked Mouse *Apodemus flavicollis* was not quite so elusive this year. An unexpected report from Burnham Deepdale puts the mouse well out of its expected range. Two caught in live traps in Scole were well within their range along the Waveney valley.

Fewer individual records for the Harvest Mouse *Micromys minutus* than in last years abnormally high list. We have returned to the usual level, but have added to the distribution map.

Brown Rats *Rattus norvegicus* were completely out of step with records that came in. Conditions helped them to increase to such a degree that numbers were high enough to cause local alarm.

Notes on the Coypu are contributed by Dr. Morris Gosling.

In last year's report I wrote that the success of the attempt to eradicate Coypus still hung in the balance. Although no Coypus had been recorded since a small group was trapped in April 1987 near St. Neots it was still far from certain that no Coypus remained in the

extensive wetlands of eastern England. This caution proved well founded and two Coypus were detected during 1988, both the victims of road accidents and both unusually old males. One was killed near Barton Bendish in west Norfolk in July and the other near Peterborough in September. Large areas around both sites were carefully checked but no further Coypus were found. There seemed no danger that these animals belonged to breeding groups and it was decided that they should not affect the planned end of the trapping campaign.

In January 1989, 21 months had passed without any evidence of Coypus other than the two elderly males. At this point, as previously agreed, the campaign ended and the Coypu Control organization was disbanded. The vehicles and trapping equipment of the 24 strong trapper force were sold off and the trappers were paid the substantial cash bonuses which had been promised in the event of a successful campaign. But although there is little chance that a viable population of Coypus remains, it will be some years before this is absolutely certain. Field staff from the ADAS Mammal Ecology Group will continue to carry out detailed surveys and follow up reports from members of the public, at least up to March 1990.

CARNIVORA

Yearling Foxes *Vulpes vulpes* at play were seen at Holme where they have become common during the past five years. A less charming side to their nature on Scolt where they took Oystercatcher's eggs, but at least they were thought to have been repaying the birds in kind. Much more seriously, a dog Fox eluded all attempts to despatch it and wreaked havoc in the ternery. It was held responsible over a period for at least 60 Sandwich tern deaths and for taking over a thousand chicks. The number of Foxes along the North Coast gave rise to concern over the year.

Young Foxes seen at an old badger sett in Central Norfolk take us back to the time when Badgers were brought in to dig holes that could be taken over in this way. One Breckland contributor saw more Foxes than ever before and over the county as a whole the species is holding its own.

From the very few records received, no proper comments can be attempted for either the Badger or the Otter.

Many references to the Stoat *Mustila erminea* and Weasel *Mustela nivalis* including flatly contradictory statements on their status. Local conditions play an important part. Recorders of lengthy experience do suggest that numbers of both are down when compared to the figures of say ten years ago. It does seem the logical result of the shrinking habitat of the prey animals taken by these tiny carnivores.

A Stoat in ermine was seen at Weyborne in the spring.

On Scolt, it was the decline in Rabbit numbers mentioned above that appears to have driven the stoats to take eggs in such numbers.

Mink *Mustela vison* were seen from Hickling in the east, across to Pentney and on to Welney in the west. Their status is not clearly focused and we need much more data. An article on Mink in East Anglia is in preparation.

CETACEA

An interesting set of cetacean records for the year, headed by the body of a young male Northern Bottle-nosed whale *Hyperoodon ampullatus* washed ashore on Scolt. Some 22 feet long, it was estimated to have been dead between one and two weeks.

Porpoises *Phocoena phocoena* were much more in evidence than in most recent years, though the numbers seen is tiny in comparison with the familiar sightings of a generation ago. Five at Paston in July represent porpoises seen every month there and others were noted most frequently off Cley. Further sightings were off Scolt, Titchwell, Trimingham,

Brancaster Staithe and Blakeney Point. A correlation with bird-watching vantage points is fairly obvious!

M. Fiszer again comes up with an unusual record entirely due to sea scanning for a Surf Scoter, followed by careful documentation, sketching and research. His notes clearly indicates a Lesser Rorqual whale passing by Holme.

ARTIODACTYLA

Notes on this group are supplied by Bill Flynn.

It is widely acknowledged that over the past twenty years there has been a significant increase in the population of most species of wild deer throughout England. This trend has been much more apparent in the southern counties, but it is now being accepted that in Norfolk there has also been a marked escalation in numbers. Any attempt to produce an accurate estimate and precise locations where the various species may be found, would, it is considered, be both foolhardy and presumptuous. These notes are, therefore, confined to general descriptions, comments, rough population sizes and general geographic areas. Norfolk must be one of the very few, if not the only, county where all six of the main wild species can be seen.

Red Deer *Cervus elaphus*. The largest of our native land mammals, and believed to be enjoying a resurgence in numbers after a period when fears had been expressed that extinction might have been threatened. A combination of poaching, road traffic accidents and sometimes ill-advised crop protection control methods seemed to be reducing known numbers to a dangerous level. New protective legislation, enlightened attitudes on management and firm and co-ordinated campaigns against poaching may have been contributory factors in what appears to be a favourable trend in population increases. Not only have significant increases in sightings been reported — both in Thetford Forest areas and in North and West Norfolk strongholds of the red deer — but even more encouraging are the confirmed reports on the excellent quality and state of health of the resident wild Red Deer. Recent observations strongly indicates that some of our North Norfolk deer may now be considered superior in quality and health to those in the remainder of the county.

Estimates of the county population vary between five and six hundred.

Fallow Deer *Dama dama*. Although some increase in numbers seem to have been generally accepted there does not appear to have been any significant evidence of colonisation of new areas. Possibly due to the fear of crop damage, numbers in mid and west Norfolk may have been contained.

Melanistic or dark Fallow appear to predominate in the Wensum Forest and mid-Norfolk areas. This would suggest the influence of the long-established melanistic herd in Melton Constable Park, especially as escapees have added to the wild stock over the years. Indications are that there are probably less Fallow than Red Deer over the county and that they are more widely dispersed.

Roe Deer *Capreolus capreolus*. Thetford Forest has long been the stronghold of the Roe Deer in East Anglia. Over the last two decades the forest has reached a level of maturity that has dictated a massive increase in forestry operations and harvesting. The varied operations from clear-felling of mature pines to the re-planting of new compartments has had a marked effect on Roe populations. Initially the Roe, disturbed by the disappearance of accepted habitat, followed the usual colonisation patterns and moved in search of alternative territory. In the southern counties of England, noticeably Surrey, Hampshire, Wiltshire and Sussex, Roe have colonised almost every small wood and even hedgerows. Around Thetford Forest there does not appear to have been any similar pattern. It would seem instead that the preference of the Roe for a mainly woodland habitat has taken them back into alternative territories within the forest. This seems to indicate that there is now an ultimately greater density of Roe within the forest which will produce a larger number

of natural migrants leading to further distant colonisation. Although we have this different pattern of colonisation here in Norfolk, it is agreed by many observers that Roe are appearing almost all over the county.

Comparisons of body weight and antler quality have often indicated that Norfolk Roe lag somewhat behind those measured in the southern counties. Where meticulous records have been kept, proof does exist that in the last decade both factors have improved in Norfolk.

Based on Roe population census figures on estates and forests where a March count is carried out, indications are that the total county population of Roe may now be in the region of six thousand animals. Evidence also suggests that the carrying capacity of the forest-type habitat has not been exceeded, and therefore a further increase can be expected before a density level is reached that might have detrimental effects on health levels.

Sika Deer *Cervus nippon*. Probably the least numerous of the species found living wild in the county and almost certainly escapees, or their progeny, from Melton Constable Park. Occasional, often unauthenticated, reports of sightings from across north and mid-Norfolk give reason to believe that some small fragmented herds may exist. There is no evidence to suggest that the Sika are likely to achieve a degree of colonising success comparable to that in the Poole basin, South Dorset, where they have been prolific and probably outnumber other wild species. With one or two exceptions, the sightings appear to have been of Japanese Sika whereas in the Thetford area they appear to have been of Formosan Sika, possibly due to the proximity of Kilverstone Park where the Formosan are resident.

The possibility of hybridisation between Sika and native Red Deer does give cause for concern. Research from areas where there has been excessive hybridisation, for example Southern Ireland, Cumbria and Galloway, all indicate an undesirable dilution of the quality and characteristics of the native Red Deer population.

Muntjac *Muntiacus reevesi*. This is the great breeding and colonisation success story of the past two decades. These little characters have built up their density and established as very firm base throughout the Thetford Forest from which their colonising marches seem to extend in all directions. There are now very few parts of Norfolk where no traces of them are seen, and much like the small asian, Chinese Water deer, with which they are often confused. Their presence in an area can go undetected so easily. Unlike native British deer, since Muntjac have no fixed breeding season, and females give birth almost invariably twice a year, their potential for rapid population expansion is easily understood.

Their preferred habitat is thick bramble or dense cover within woodlands and as predominantly browsing rather than grazing animals they are not renowned as potential crop damagers of a serious nature. Add to this a natural reluctance to manage or control this species, situations may arise in the future — as they have elsewhere in the past — when a surreptitious escalation in numbers suddenly reaches the point where damage reaches an unacceptable level. It is then that these otherwise attractive little creatures rapidly lose their popularity. It is possible they are already as numerous as the Roe Deer in the county and may soon exceed them.

Chinese Water Deer *Hydropotes inermis*. These are probably the most secretive and shy of our wild deer species. Their choice of habitat almost invariably means their presence remains unknown for an amazing length of time. They seem to select the most inaccessible areas and thrive where humans rarely, if ever, go. Throughout Broadland, along the Waveney Valley, and even the North Norfolk coast, their colonisation of some of the really wild areas has gone on almost unnoticed. Their procreative potential is enhanced by the fact that multibirths are normal, with low infant mortality and high survival rates. Triplets are common, whilst four, five and even seven have been recorded.

Originating from the marshlands of S.E. China, our marshland wildernesses could provide a haven in which they are likely to thrive for many years to come.

NORFOLK & NORWICH NATURALISTS SOCIETY (Reg. Charity No. 291604)

Patron: Her Majesty the Queen Founded in 1869

The County's senior natural history society. It has for its principal objectives the practical study of natural science, the conservation of wild life, the publication of papers on natural history, especially those related to the county of Norfolk, arranging lectures and meetings and the promotion of active fieldwork. Specialist Groups cover most aspects of the county's flora and fauna.

Annual Subscription Rates:
Junior £3.00
Ordinary £6.00
Family £7.50
Affiliation £15.00

Publications:
May: Transactions
August: Bird & Mammal Report
Quarterly newsletter 'Natterjack'

Secretary:
A. L. Bull
Hillcrest
East Tuddenham
Dereham NR20 3JJ

Membership Secretary:
C. R. Dack
12 Shipdham Road
Toftwood
Dereham NR19 1JJ.

NORFOLK ORNITHOLOGISTS ASSOCIATION (Reg. Charity No. 267670)

for Birds and Bird-watchers

The N.O.A. was established in 1970 to act as a parent body to Holme Bird Observatory (est. 1962), to further knowledge of ornithology, especially migration, to conserve habitats and disseminate knowledge of natural history through its wardens and reports.

Our Reserves are:

Holme Bird Observatory
By agreement & Purchase. Full-time Warden. 296 species seen in area 384 species of moths recorded.

Walsey Hills Information Centre & Migration Watch Point
Originally est. 1949. Purchased 1973. A vital migration watch-point. Seasonal Warden.

Holme Marsh Bird Reserve
Est. 1976. By agreement. 90 acres of relict grazing for waders & wildfowl. Part-time & voluntary wardening.

The Quags, Kelling
A 14 acre rough grazing marsh with pool purchased 1984. Passage and resident waders.

Redwell Marsh, Holme
A 35 acre wetland pasture purchased 1985.

Annual Subscription rates:
Individual £8.00
Husband/wife £11.00
Family £12.00
Junior £4.00
Single Life Membership £125.00

Members receive: free permits to our reserves, free N.O.A. Annual Report (pub. March), free Norfolk Bird & Mammal Report (pub. Aug.) and 2 News Bulletins.
Address: Norfolk Ornithologists Association (Office), Aslack Way, Holme next Sea, Hunstanton, Norfolk PE36 6LP.

Printed in England by Witley Press Ltd , Hunstanton, Norfolk

- 2 AUG 1990
ARY

TRANSACTIONS
of
THE NORFOLK & NORWICH NATURALISTS' SOCIETY

Vol. 28 Part 5 July 1990

TRANSACTIONS OF THE NORFOLK AND NORWICH NATURALISTS' SOCIETY

ISSN 0375 7226 Volume 28 Part 5 (July 1990) Editor A.G.Irwin

OFFICERS OF THE SOCIETY 1989-1990

President: Mrs A. Brewster

Vice-Presidents: R. Baker, P.R. Banham, A.L. Bull, K.B. Clarke, E.T. Daniels, D.A. Dorling, K.C. Durrant, R. Jones, Mrs J. Robinson, M.J. Seago, E.L. Swann, F.J. Taylor Page

Chairman: Mrs A. Brewster, "Four Winds", Corpusty, Norwich, NR11 6QQ
Secretary: A.L. Bull, "Hillcrest", East Tuddenham, Dereham NR20 3JJ
Asst. Secretary: Mrs J. Negal, "Inishmore", Newton Flotman
Treasurer: D.A. Dorling, 6 New Road, Hethersett, Norwich NR9 3HH
Asst. Treasurer: M.J. Woolner, 45 Gurney Road, Norwich NR5 0HH
Membership Committee: R.Hancy (*Chairman*), C.Dack (*Secretary*)
Programme Committee: M. Ewles (*Chairman*), Mrs C. Haines (*Secretary*)
Publications Committee: R. Jones (*Chairman*), A.G. Irwin, M.J. Seago, R. Hancy (*Editors*)
Research Committee: P.R. Banham (*Chairman*), E. Cross (*Secretary*)
Hon. Auditor: J.E.Timbers, The Nook, Barford

Elected Members of Council:
(Retiring 1990) Mrs M. Cooper, N. Gibbons, R. Hamond, M. Smith
(Retiring 1991) R.E. Jones, G. Philips, E.M. Thain, B. Sage
(Retiring 1992) N. Carmichael, J. Dawson, M. Hall, A. Leech
Co-opted and Representative Members of Council:
Dr Irwin(*Museum*) serves as an officer. Dr W.Sutherland (*University*) R.Hobbs (*Norfolk Naturalists Trust*), P.Wright (*Nature Conservancy Council*)

ORGANISERS OF PRINCIPAL SPECIALIST GROUPS

Birds (Editor of the Report):
M.J. Seago, 33 Acacia Road, Thorpe St Andrew, Norwich NR7 0PP
Mammals (Editor of the Report):
R. Hancy, 124 Fakenham Road, Taverham NR8 6Qh
Bats: J.G. Goldsmith, Castle Museum, Norwich NR1 3JU
Amphibia & Reptiles: J. Buckley, 22 Aurania Avenue, Nowich
Higher Plants: A.L. Bull, "Hillcrest", East Tuddenham, Dereham (East Norfolk)
Mrs G. Beckett, Bramley Cottage, Stanhoe, King's Lynn PE31 8QF (West Norfolk)
Mosses & Liverworts: C.R. Stevenson, 111 Wootton Road, King's Lynn
Algae: K.B. Clarke, Decoy House, Browston, Great Yarmouth
Fungi: R.E. Evans, "Chantrelle", Church Road, Welborne, Dereham
Insects: K.C. Durrant, 18 The Avenue, Sheringham NR26 8DG
Mollusca: R.E. Baker, 25 Southern Beach, Mulbarton NR14 8BU
Marine: Dr R. Hamond, Scaldbeck, Morston, Holt, NR25 7BJ
Freshwater: R.J. Driscoll, Castle Museum, Norwich NR1 3Ju
Photography: R. Robinson, 5 Southern Beach, Mulbarton NR14 8BU

FRONT COVER : The Norfolk hawker, *Aeshna isosceles*.
(*R.E. Jones, from a photograph by P. Pratley*)

BRITISH MUSEUM
NATURAL HISTORY
2 AUG 1990
ACQUIRED
LIBRARY

IN SEARCH OF WILDLIFE

THE PRESIDENTIAL ADDRESS DELIVERED TO THE SOCIETY ON 2 OCTOBER 1989

M. A. Brewster

"Four Winds", Corpusty, Norwich NR11 6QQ

Ladies and Gentlemen—

It is a very great honour to be President of this Society. I found it difficult to decide on a title for this evening—I had considered the Past, the Present, the Future, Farming and Wildlife, or with my many interests 'In search of everything' would have been more appropriate.

Introduction

Corpusty and Saxthorpe are twin villages on the B1149 Norwich to Holt Road. As with any village there is always something waiting to be discovered. In the not too distant past stone axes, Roman and medieval pottery have been found, a medieval site uncovered, coal seams found when a borehole was sunk while exploring for gas and more recently the remains of mammoth and many other animals were found at a site in the next village.

Looking at the Enclosure Map of 1842 one finds many of the names still in use today. These give a good indication of the terrain and industry of the past. Some examples are Broom Hills, Fullmill, Dam Meadows, Tan Office Farm, Retting Bridge, Great Breck, Heather Close, Gravel Pit Eight Acres, Leech Pit and Marl Pit Piece. I have spent many hours with our local historian Janet Wilson walking the fields looking for signs of the past.

A general picture of the villages is that of undulating countryside. The River Bure (bordered by alder carrs, overgrown meadows and good grazing meadows) divides and winds its way through the villages. There are approximately 3000 acres of intensively farmed land but with a variety of wildlife habitats. This variety is due to the different management undertaken by the twenty-four owners. I have been collecting records for at least 20 years and most sites are visited regularly. After these visits my list of species for each site is updated. As well as this, there are many special surveys of deer, amphibians, dragonflies, etc., that produce numerous notes in diaries and elsewhere.

The river

The River Bure varies in composition and depth throughout—flowing over very shallow gravels but also with deep muddy places especially on the numerous bends. Many of the bends have been cut through in the past 50-60 years—often leaving a damp site which in time becomes an alder carr. Eight other small streams flow into the Bure thus creating a good network of waterways. The kingfisher is regularly seen in a number of places. The heron is very common—pellets collected during the past few years mainly contain the remains of water voles but the occasional mole, frog and crayfish are sometimes seen.

On one small area on the river bank—trampled by cattle—grows the mousetail. First discovered in 1976 this has been checked over a number of years. Its abundance varies due to condition of ground before germination. If there is too much grass the seedlings cannot survive resulting in very few plants.

The coypu was at one time seen by a number of people but has now been controlled by the authorities. Otter tracks were seen in the snow in 1979. Many of the bridges and other likely places along the river bank have been checked but there has been no definite sighting. It is believed that one did visit the local trout fishery a year ago.

Throughout the villages the banks of the river are covered in flowering plants and liverworts. The banks of one small stream on old heathland soon gets overgrown with gorse if not cut back regularly, other plants here include the hard-fern, heathland mosses and liverworts.

Meadows

A variety of meadows border the River Bure, some of which are grazed by cattle, on others a pony or horse. Some meadows have been sprayed but small areas especially near ditches can often be found covered in wetland plants. A number of these meadows has been checked for many years. One meadow in particular has been monitored since 1975 when there was an abundance of plant communities throughout. For a number of years it was sprayed regularly and grazed by cattle or a horse. By 1984 the 'flowering' area was very small (close to one ditch where the sprayer did not quite reach). Spraying was then stopped and by 1989 most plants had returned to their former glory including one unwelcome plant—the Himalayan balsam. Another meadow of improved grassland with very few plants except along the stream bank in the centre is one of the main nesting areas for the oystercatcher which has been coming here since 1982.

Throughout the area some very good ditches can still be found and on checking my records for the last ten years the frog population seems to have increased. Eels are occasionally seen and the ditches are also used by snipe and water rail. A species of stonewort is found in two ditches also the liverwort *Pellia endiviifolia*.

Many of the overgrown meadows are a mixture of fen, alder carr and bog. Three meadows last used 60 years ago are completely overgrown with common reed and alders. A large colony of alternate saxifrage grows near a drainage ditch in this very boggy area and has been traced to five other sites along the Bure. Another site, studied yearly since 1975 when it was an alder carr, was completely cleared by pigs. Plant life varied from year to year depending on the water table. Bristle scirpus and bur marigold were found here. Soil was taken from the centre for use in local greenhouses thus leaving a depression in which a variety of plants then grew and dragonflies and damselflies visited. In 1984 the pigs were sold and seedling alders were coming up in profusion around this depression—by 1989 it was well on the way to becoming another alder carr.

It was in these damp overgrown areas that the main search for the harvest mouse took place. By searching the dead vegetation during the winter months, I found nests at most sites. At last realising how easy it was to spot the nest in cocksfoot grass and then searching other sites on drier ground and eventually all field edges I find the harvest mouse although not abundant is widespread throughout these and other villages.

Verges

Verges vary from upright shady banks to the extensive verges widened during the last war to allow access to a local aerodrome or more recently for road improvements. The verges were first surveyed in 1971 and continually checked. Management again

varies with the owner and also the Highways Department. Crosswort, long stalked cranesbill, sheepsbit and erect brome grass are the four important plants. Having found an extensive patch of the liverwort *Reboulia hemisphaerica* on one sandy bank it was surprising to find it widespread throughout.

Arable fields

To understand the farming practices of today one needs to have been connected with the industry and seen the changes that have taken place during the past 40-50 years. Having been brought up on a small self-sufficient farm, (the days of the binder and butter making), seen our lovely Suffolk mares replaced by a Standard Fordson tractor, having watched and later helped with the harvest, cutting out sugarbeet and watched the hard work of ditching by hand, I am in a position to appreciate the vast amount of mechanisation as seen today. Having also been connected with Agricultural Engineering since 1955, I have seen the cost of equipment and spares escalate and from this the gradual decline of the small farm—whether rented or owned.

Many fields are cultivated in the autumn for the winter cereals but a number of stubble fields are left for the spring-sown cereals, potatoes, peas and beans. A survey carried out in November 1984 on 33 stubble fields in and around this area were found to contain numerous patches of the liverworts *Riccia sorocarpa* and *Riccia glauca* which are also found in sugarbeet and potato fields. The hedgeless fields on the higher ground during October and November are covered with flocks of lapwing and golden plover. It is not unusual to see 400—600 of either bird.

Sprays are used for most crops but often the corners and the unsown strip around many fields are missed. The BSBI Arable Weed Survey of 1987 gave some pleasing results. Having seen Venus's looking glass growing in one area only, with intensive searching around the perimeter and in gateways this was found, sometimes in abundance, in many fields. The largest number was found growing with heartsease and night-flowering campion in an unweeded strawberry field. Other uncommon arable weeds found were lesser snapdragon, fluellen , field woundwort and one plant of dwarf spurge . The long rough headed poppy was also seen including seven plants growing on a farmyard wall with a total of over 200 heads.

The oystercatchers, now one of our summer residents, have been reported on a number occasions, following tractors and equipment (similar to the habit of black headed gulls) up and down fields. Very little stubble is burnt. Many of the fields are undersown with grass and some with stubble turnip. This is mainly in an area where there is a large herd of cattle and a large flock of sheep. The area is very good for birds, including the grey partridge, and insects.

Hedgerows

There is a network of hedges throughout although a few have been removed. The type of hedge depends on management by the owner. Most hedgerows were brushed just before harvest each year but now they are trimmed when access is possible after the crop has been harvested.

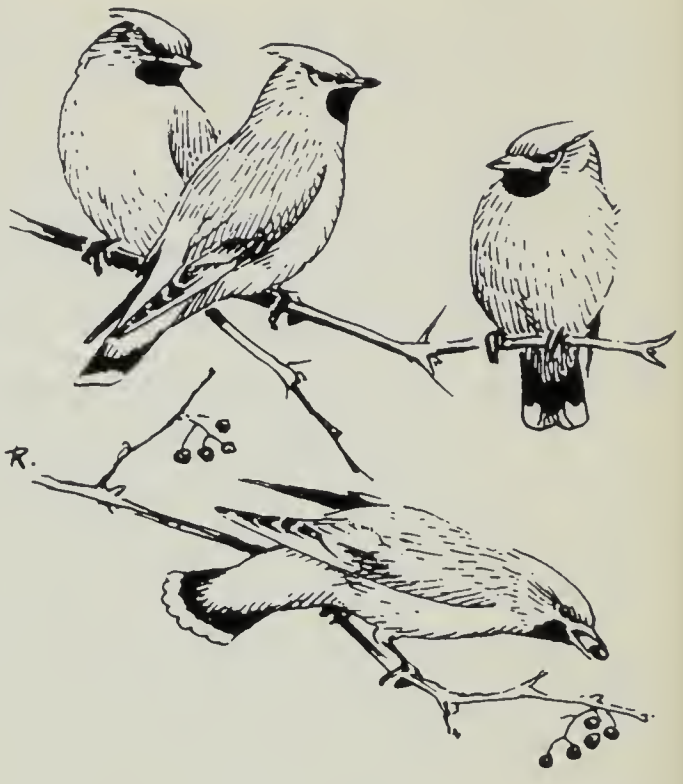
Many of the hedges date back to the enclosure time and have very few species. A total of 50 hedges were checked in 1984. Along each hedge 5 sections of approximately 30 yards were paced and species listed. Of the 50 hedges checked, oak trees were found in 31 of these. Further trees could also be growing along the rest of the hedge. Ash trees were found in eight hedges, hornbeam, willow and alder in

one each. Sixteen of the hedges bordered roads.

The number of species per hedge ranges from 3 to 7 giving an average over 50 hedges of 5.

Number of times each species counted:

hawthorn	215
rose	178
blackthorn etc. (*Prunus* spp.)	167
oak	129
maple	122
hazel	101
ash	94
holly	67
elder	54
elm	45
crab apple	18
sycamore	11
dog wood	10
alder	10
bird cherry	9
willow	7
spindle	6
rowan	3
hornbeam	2
cherry	2
berberis	1
small-leaved lime	1



Heathland

No large area of heathland remains but ling and bell heather can be found in a number of places throughout. The adder has been recorded in three different places.

Woodland

There are three mixed woodland areas, mainly on sandy soil. Much of the woodland area, felled in the 1940's was replanted with Scots pine, spruce and larch. Two plantations have recently been replanted but this time with oak, sweet chestnut and beech and for a few years the ground flora will be checked for heathland-type vegetation. Many of the small trees have already been damaged by the red deer which are in the area. Various notes are made on these each year in order to determine the population but with other woodlands nearby this is difficult. The red squirrel last seen in 1980 has now been replaced by the widespread grey squirrel. The area not planted is covered with bracken, birch and rhododendron. Coppicing was at one time a common feature here but very little is carried out at the moment. Eventually it is hoped that the area is coppiced once again and so encourage the woodland flora that is already seen on the pathways. A number of mature deciduous trees still exist but many were blown down in recent years during gales. Trailing tormentil is widespread and one of the woods is covered with bluebells and bird cherry during spring. Mossy tillaea is found on one of the sandy paths. The fox is very common and controlled.

Records of sightings of the badger were reported in 1978 and 1980. In 1982 badger tracks were found on two occasions but with intensive searching throughout the whole village no sett could be found. The muddy pathways have been checked every year since.

Sandpit

Sand and gravel excavations have taken place in the past. The many small places dug by hand 50—60 years ago for use on the roads have now been filled and levelled. The larger sandpit last used in the late 1950's still exists today as a rifle range. At one time it was the main nesting site for sand martins but having been levelled in 1973 and buildings added later for the shooters, the increased activity has discouraged the birds from returning. The perimeter has a very good covering of trees and shrubs and still attracts the summer warblers and other birds. Plants found here include viper's bugloss, heath spotted orchid, ratstail fescue—the flora having changed very little since 1972. In the recent butterfly survey this proved to be one of the best sites.

Ponds

Marl has been taken from the villages for a number of years. The old lime kiln, last used in 1958, has two very large ponds and three smaller ones with an abundance of water life. This is the only site locally for the great crested newt. The area between the ponds is overgrown—an ideal site for birds—and in the clearings an abundance of bee orchid (checked every year), fairy flax and ox-eye daisy. In a much older site nearby Natterer's and Daubenton's bats have been found.

A number of other ponds exist in the villages. A complete survey of the toad population was carried out in 1978/79. Toads congregate at most places each year and although the average spawning depth is 11 inches, if the pond is short of water they will spawn in 2 inches of water. Ponds are often overcrowded and numbers difficult to count but the populations seem to have been maintained. In the recent dragonfly survey a number of species were recorded from here. Vegetation varies but most ponds are very rich in aquatic life and only two seem to be affected by pollution. Glaucous rush grows extensively in two ponds. Hairy rush on the edge of one of the ponds.

Railway track

There are approximately 2 miles of old railway track, coming in at the south east corner of Corpusty, curving towards the centre of the villages and out again in the south west corner over the Blackwater bridge and containing four cuttings and four embankments. Since the railway closed in 1959 some of the track has been incorporated into farmland (the track is owned by nine individuals). Although now overgrown in places it provides a secluded and relatively undisturbed area for wildlife. It was first surveyed in 1971 and again more thoroughly in 1980 for the Railway Track Survey. The track is regularly walked, very good for butterflies and other insects. The narrow bordered burnet moth is found in the same place each year. Tall broomrape grows in one area. Pigs were at one time put in one of the cuttings and the following year the green-winged orchid was found. The site of the station was turned into a field study centre. The striated catchfly has been seen on the banks since 1971.

Buildings

Many of the old farm buildings are in a dilapidated state—no longer suitable for modern day machinery. The barn owl still uses these buildings and pellets have been checked since 1976 giving a good indication of the small mammals in the area, especially water shrews which are not seen so often. The main food is the field vole.

Huts which have been standing since the last war (originally site of searchlight unit) have now fallen down. Swallows have always nested here and this is another bird whose nesting sites are gradually disappearing.

Waste ground

A splash of poppies in the centre of the villages is a sure sign of pending development. As with other villages much infilling has taken place, and two fields have disappeared. One small two-acre field was checked every year from 1973—1985. This field was originally used for crops but was later left fallow pending development. Several species of rare arable weeds have now gone under new houses.

Gardens

There are now approximately 300 dwellings in the two villages with various sized gardens, many with ponds and a variety of garden plants to encourage butterflies and other insects. No one tolerates annual weeds! A pipistrelle count at one of the new bungalows in August 1987 gave a total of 206.

August	1	206
	2	198
	3	188
	5	138
	8	120
	10	97
	14	nil

I have recently been involved with the British Trust for Ornithology garden bird survey along with at least two other people, one with a small garden and the other the Mill Garden (home of John Last, who draws the vignettes for our Mammal Report). The waxwings if coming into the country always visit my garden with its orchard and hedge of hawthorn. I am currently making notes of the moths visiting the garden.

Churchyards

Two churchyards contribute to the wildlife of the area although this varies year to year due to the management of each site. Parts if left uncut throughout spring and early summer are ideal places for the butterflies. The flora varies—it is not exceptional but could be improved with management. This is the only site for the hoary plantain. Slow worms are occasionally seen. Maidenhair spleenwort grows on Saxthorpe Church. Sheep are sometimes used to keep some of the grass down. Thoroughly checked in 1980 for the W.I. Survey.

Since 1976 I have held various exhibitions in our village hall and since 1986 have taken a Nature Group at the local school. This is not a conservation area—but I hope from my interest in collecting this information I have shown that to get a true picture you really do have to go 'in search of wildlife'.

Acknowledgements
For assistance and encouragement over the years I thank A. Bull, R. Hancy, K. Durrant, R. Evans, E. Daniels, the staff, past and present of the Natural History Department at Norwich Castle Museum, the late E.L. Swann and many others.

Appendix
Scientific names of animals and plants mentioned in text.

adder *Vipera berus*
badger *Meles meles*
barn owl *Tyto alba*
black headed gull *Larus ridibundus*
coypu *Myocastor coypus*
crayfish *Austropotamobius pallipes*
Daubenton's bat *Myotis daubentoni*
eel *Anguila anguila*
field vole *Microtus agrestis*
fox *Vulpes vulpes*
frog *Rana temporaria*
golden plover *Pluvialis apricaria*
great crested newt *Triturus cristatus*
grey partridge *Perdix perdix*
grey squirrel *Sciurus carolinensis*
harvest mouse *Micromys minutus*
heron *Ardea cinerea*
kingfisher *Alcedo althis*
lapwing *Vanellus vanellus*
mole *Talpa europaea*
narrow bordered burnet moth *Zygaena lonicerae*
Natterer's bat *Myotis nattereri*
otter *Lutra lutra*
oystercatcher *Haematopotus ostralagus*
pipistrelle *Pipistrellus pipistrellus*
red deer *Cervus elaphus*
red squirrel *Sciurus vulgaris*
sand martin *Riparia riparia*
slow worm *Anguis fragilis*
snipe *Gallinago gallinago*
swallow *Hirudo rusticus*
toad *Bufo bufo*
water rail *Rallus aquaticus*
water shrew *Neomys fodiens*
water vole *Arvicola terrestris*

alder *Alnus glutinosa*
alternate saxifrage *Chrysosplenium alternifolium*
ash *Fraxinus excelsior*
bee orchid *Ophrys apifera*
beech *Fagus sylvatica*
bell heather *Erica cinerea*
birch *Betula pendula/pubescens*
berberis *Berberis vulgaris*
bird cherry *Prunus padus*
blackthorn *Prunus spinosa*
bluebell *Endymion non-scriptus*
bracken *Pteridium aquilinum*
bristle scirpus *Scirpus setaceus*
bur marigold *Bidens cernua*
cherry *Prunus cerasifera*
cocksfoot grass *Dactylis glomerata*
common reed *Phragmites australis*
crab apple *Malus sylvestris*
crosswort *Galium cruciata*
dogwood *Thelycrania sanguinea*
dwarf spurge *Euphorbia exigua*
elder *Sambucus nigra*
elm *Ulmus glabra*
erect brome grass *Bromus erectus*
fairy flax *Linum catharticum*
field woundwort *Stachys arvensis*
fluellen *Kickxia elatine*
glaucous rush *Scirpus tabernaemontani*
gorse *Ulex europaeus*
green-winged orchid *Orchis morio*
hairy rush *Luzula pilosa*
hard-fern *Blechnum spicant*
hawthorn *Crataegus monogyna*
hazel *Corylus avellana*
heartsease *Viola tricolor/V. arvensis*
Himalayan balsam *Impatiens glandulifera*
hoary plantain *Plantago media*
holly *Ilex aquifolium*
hornbeam *Carpinus betulus*
larch *Larix decidua*
lesser snapdragon *Antirrhinum orontium*
ling *Calluna vulgaris*
long rough headed poppy *Papaver argemone*
long stalked cranesbill *Geranium columbinum*
maidenhair spleenwort *Adantium trichomanes*
maple *Acer campestre*
mossy tillaea *Crassula tillaea*
mousetail *Myosurus minimus*
night-flowering campion *Silene noctiflora*
oak *Quercus robur*
ox-eye daisy *Chrysanthemum leucanthemum*
rhododendron *Rhododendron ponticum*
rose *Rosa sp.*
rowan *Sorbus aucuparia*
Scots pine *Pinus sylvestris*
sheepsbit *Jasione montana*
small-leaved lime *Tilia cordata*
spindle *Euonymus europaeus*
spruce *Picea abies/P. sitchensis*
stonewort *Chara sp.*
striated catchfly *Silene conica*
sweet chestnut *Castanea sativa*
sycamore *Acer pseudoplatanus*
tall broomrape *Orobanche elatior*
trailing tormentil *Potentilla anglica*
Venus's looking glass *Legousia hybrida*
willow *Salix sp.*

THE END OF AN ERA

E.T. Daniels

41 Brian Avenue, Norwich

Following the Society's publication in 1914 of Nicholson's "Flora of Norfolk", plant recording in the County was at a low ebb for nearly four decades, except for ecological studies of special sites. To a large extent this reflected the position in the country at large. The situation changed in the early 1950's with the appearance of Clapham, Tutin & Warburg's great classic "Flora of the British Isles", and the decision of the Botanical Society of the British Isles to prepare and publish an "Atlas"—a series of maps, one for each species, showing in which 10 km square of the Ordnance Survey of the British Isles such species occurred. This entailed enisting the aid of a huge team of Recorders, many in Norfolk and chief of whom were the three botanists commemorated below:

Richard Pearse Libbey (1911—1987)

He was born in Yorkshire and was the only one of the three to have been University trained in Botany and to have gained his livelihood by the practical application of that subject. He graduated from Reading in 1936 with a BSc degree in Agricultural Botany and after a period of research he joined the Staff of what is now the Sports Turf Institute until the outbreak of War in 1939 when he volunteered for the Army but was directed to Norfolk to become a member of the War Agricultural Committee, which enabled him to study an arable field flora long since vanished, specially in West Norfolk where the carrot fields sprouted a great crop of alien plants brought over from America with lease-lend seeds. After the War he returned for a time to Yorkshire but then settled in King's Lynn to work for a fertiliser firm. He was widely in demand over sports green matters and sometimes was an expert witness in law disputes over supplying seeds or turf.

On retirement he had leisure to pursue his absorbing interest in Botany and from 1971 onwards partnered Eric Swann in innumerable plant searches in the County, particularly in Breckland and coastal areas. They would often join the writer for a foray into East Norfolk to find species not available in the West. He travelled abroad on family visits and thus got to know at first hand floras of Brazil, Canada, Lapland, Pakistan and eastern USA. He met botanists in those areas, but at home was well-known throughout Britain from his custom of attending Conferences, etc. of the Botanical Society of the British Isles, which he joined in 1943. The next year he joined our Society and served on our Committee in 1979. As well as seed plants, he was keen on mosses and liverworts and joined the British Bryological Society, serving for a time as Council member. The last two years of his active life were devoted exclusively to bryophytes.

He was a complete enthusiast for plants, an acknowledged expert on grasses and *Oxalis* of which he was the national referee for the BSBI, and willingly took great pains over specimens and queries sent to him. As a companion in the field his great knowledge of botany stood out, but he was a modest man, and although firm and forthright in his views was never patronising to others. He formed a very large herbarium of nearly 12,000 specimens. The vascular plants went to Reading University and the bryophytes to Norwich Castle Museum.

Right from his undergraduate days and throughout life he had grave health

problems necessitating surgical treatment and sometimes serious operations, but between times he was active and cheerful and always ready to have a go. He was a tall, spare, gaunt-faced man with abounding energy. A tennis player and keen golfer he found *Poa bulbosa* on the links at Snettisham and *Juncus ambiguus* in vehicle ruts on the same site. In the company of the Canadian Pierre Taschereau (a world expert on *Atriplex*) the exceedingly rare and elusive *Atriplex longipes* was found at Brancaster and an account by him was published in "Transactions". Other published records are full of his finds in Norfolk, a number of them "firsts" for the County.

He died at King's Lynn on 26 August 1987, leaving a widow, two sons and a daughter.

Charles Plowright Petch (1909—1987)

Dr. Petch was the doyen of the three botanists commemorated in this paper, as from early schooldays he was a dedicated plant lover, which he continued to be for the rest of his life. While at Gresham's he found many plants of great rarity locally—and some nationally so—and he recorded some of these in our "Transactions" as far back as 1928/9 and 1929/30. He was a botanist of unusual quality.

Born at North Wootton, he was educated at Gresham's, Holt and St. John's College, Cambridge, obtaining a Double First in Natural Sciences. He then became a school master at Stowe for a year, after which he left to get his medical qualifications, to enable him to practise as a physician for the remainder of his working life, interrupted by service in the 1939-45 war as a Medical Officer in the RAF. When still an undergraduate he stayed on the then remote and nearly inaccessible island of St. Kilda to pioneer a vegetation study there, and his paper in the 1933 "Journal of Ecology" brought his name to an international readership and is still cited by researchers.

He lived in Surrey until retirement and became a prominent founder member of the Surrey Flora Committee which sponsored J.E. Louseley's "Flora of Surrey". Louseley died suddenly before the work was fully written, but Charles and the late Dr Cecil Prime completed the text and saw the work through to publication. He did not allow these commitments to interfere with his keen practical interest in his native County where he spent his holidays and often came up at weekends to botanise. Thus came about his partnership with Eric Swann so rich in results. They jointly published in 1962 "West Norfolk Plants Today" written as the Supplement to the "Proceedings of the Botanical Society of the British Isles", followed two years later by a further list, and in 1968 by the "Flora of Norfolk". When he retired in the early 1970's he came back to Norfolk to live at the Manor House, Wolferton, for the remainder of his days.

He continued actively with botany, becoming the West Norfolk Recorder for the BSBI (which he joined in 1952) when Eric Swann relinquished the post. He made a number of valuable contributions to our "Transactions" embodying the results of more than 60 years fieldwork in West Norfolk. His last paper published the results of a very important monitoring of all sites known to him for 50 years of Matted Sea Lavender (*Limonium bellidifolium*). He led numerous excursions and was prominent as a Recorder for P.J.O. Trist's "An Ecological Flora of Breckland". He did much work in the Stanford Training Area for Eric Swann's privately published "Flora " of that site. His interests were not confined to vascular plants as he was an accomplished mycologist as was our one-time President, his grandfather, C.B. Plowright. Each chose an aspect of mycology as his Presidential Address to

our Society—Charles was President in 1981-2.

Members who recall our field meetings of the 1960's will remember a tall bespectacled figure emerging from an old silver-grey Bentley and wearing an equally antique pork-pie hat and a somewhat reserved manner, but a tireless walker until knee trouble in 1978 called for an operation leading to three months on crutches and a stick for much of the rest of his life. This was not allowed to interfere with his plant pursuits. He was celebrated among his colleagues for being able to pin-point the exact location of a rare plant he had previously found. My last outing with him was to find the May Lily (*Maianthemum*) in a wood changed beyond recognition since he knew the species there years before, but Charles went to it. He was very willing to share his knowledge but not to the extent of spoon-feeding. In a West Norfolk site where one of the pingoes was solid with *Cladium* he turned to a young hopeful and said "*Liparis* (the fen orchid) is there. Go in and find it".

He enjoyed playing the 'cello and was fond of sailing in the creeks and harbours of North Norfolk. He managed to cope with a hospital consultancy, a private practice, beagling, sailing, walking, music and entertaining. Somehow botany got fitted in!

He died very suddenly and without warning at his home on 8 December 1987, leaving a gap in the ranks of naturalists whose lives he enriched. He left a widow and two sons.

Eric Lister Swann (1904—1989)

Eric Swann brought unusual qualities of energy, enthusiasm and skill to botanical study, almost all of it in Norfolk, and he achieved much renown in this country and overseas despite the great pride he took in being, as he thought, "provincial". His activity was continuous over a period of 50 years.

He was born at King's Lynn, and on leaving school he joined the staff of Barclays Bank at King's Lynn for most of his working life. He became attracted to botany in the late '30's and joined our Society in 1938 and what subsequently became the BSBI the following year. The latter body was reorganised just after the 1939-45 War after its Secretary was killed and its records destroyed in an air raid. This entailed a vast amount of work by a devoted unpaid team among whom was Eric—as Hon. Treasurer until 1958. In appreciation of this great service he was made an Honorary Member.

He served our Society for a number of years as Honorary Auditor, was President in 1956 and subsequently made Vice-President until obliged to resign due to advancing years. It was typical of Eric that he would not hold a post without fulfilling what he regarded as the obligations which went with that post. Thus, when he was made a Fellow of the Linnean Society in 1972, he resigned after a few years because he could not participate. He was Recorder for West Norfolk for the BSBI and Hon. Warden of Roydon Common for the Norfolk Naturalists Trust. He led innumerable excursions and study parties to special sites.

Quite early on he specialised in willows, sedges, grasses and eyebrights (*Euphrasia*). The fieldwork and collecting necessary for these were massive, as well as the correspondence with international authorities. His Norfolk work began in 1938 and soon the idea of writing a Flora was born, so that at a Committee of our Society held in 1960 to consider centenary celebrations Eric offered his extensive card index and offered to write, jointly with Dr. Petch, the first Norfolk Flora since Nicholson. When he retired in 1964 he was able to give full time to the typescript

and further fieldwork and back-checking of records. The Society helped in this with field meetings to record special things and sites. Finally, in Spring 1968 the completed work was offered to us and through the good offices of Reg Jones, Messrs Jarrold agreed to publish, but insisted that coloured plates should be included. It was the first County Flora to be so illustrated and started a trend followed in subsequent Floras. The enthusiasm generated resulted in a spate of fresh records, justifying a Supplement in 1975, with Eric as sole author, and annual Plant Reports in "Transactions" followed.

Parallel activities took the form of joining in a 10-year survey of Breckland and organising a plant recording scheme for the Stanford Training Area, the results of which were printed privately and at his own expense. He was made President of the BSBI and his 1976 Presidential Address was entitled "Norfolk and Botany".

From 1955 onwards he gave great attention to mosses and liverworts and added many new records to the Norfolk list. He joined the British Bryological Society, contributing to their Journal in 1982 an important paper "Norfolk Bryophytes Today", which embodied his work since about 1930.

His collaboration with Charles Petch was not devoid of drama, as their views clashed on several matters. Charles had little use for "aliens" to which Eric was partial. Also, Eric was attracted to plant entities below the level of species, to which Charles referred slightingly as "minor taxonomic units". Charles strongly opposed the inclusion of plants which had never been found in Norfolk, but was countered with the dictum "No, but they ought to be and will soon be". An agreement was reached that such should be shown in square brackets, and such local patriotism was finally vindicated in the case of the Spear-leaved Willow-herb (*Epilobium lanceolatum*) which turned up for the first time after the Flora was published. In general, however, the partnership was happy and productive and continued until Charles died.

He had a fine library with important European and American works and formed a large herbarium mainly of Norfolk material.

He often led our excursions, and many will remember a short, bespectacled and rather portly figure, generally with a soft pepper-and-salt trilby, more often than not a cigarette in his mouth and wearing a misleading expression of solemnity. In the most helpful way he instructed the less experienced in field identification, and he sometimes made what he well knew were deliberate mistakes, just to invite contradiction. If this happened his pleasure was evident to those who knew the signs. As a correspondent he was exemplary, nearly always replying by return of post, often at great length with lavish quotes from authorities and in polished prose. He had much to put up with healthwise. A chronic ear condition led to recurring dizzy bouts and spells in bed. Arthritis caused much falling about with bruising and fractures, so that he had eventually to walk with stick. His last few years were very distressing and he was almost totally house-bound, in fact confined to a downstairs room for a period.

Outside botany he enjoyed fishing and watching tennis and, as a young man, Speedway events. He and his wife, Marjorie, were keen gardeners with a lawn good enough for them to play each other at bowls. Both were regular attenders at the King's Lynn Festivals, as Marjorie was a talented artist—she illustrated his paper in "Transactions" on the American Willow-herb (*Epilobium adenocaulon*) which he was the first to find in Norfolk.

Eric died in Queen Elizabeth Hospital, King's Lynn, on 22 May 1989 where

Marjorie was also a patient at the time. His was a life of great achievement and he was unstinting in sharing his gifts with others and in advancing the cause of Botany in Norfolk. He had great regard for our Society, on which he shed lustre and in his Will made a bequest of £500 to it. His herbarium was left to the Castle Museum.

* * *

It was a happy thought of your Council that appreciations of these outstanding botanists should appear together, as it was felt that a rather special era had ended with their passing. Botanists will continue to work in Norfolk and to make fresh discoveries, but the forming of large, private herbaria is probably a thing of the past. The development of taxonomy will pose problems for field workers as some plants cannot be named without breeding experiments and cytological studies. Also, the old method of recording which basically used the Parish as a unit will be replaced by grid square methods with dot maps replacing narrative to a large extent. Norfolk Naturalists have cause to be grateful that the second half of the century saw three such eminent field workers recording our wild flora.

References

Editor's Note: Because of the nature of this paper, we have departed from the standard practice of giving an 'author, date' reference to a publication in text. However the references can be found easily in the following list. It is hoped that a full bibliography of these three eminent botanists will appear in a future issue of Transactions.

CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. 1952 *Flora of the British Isles*. Cambridge: Cambridge University Press.

LIBBEY, R. P. 1977 *Atriplex longipes* Drej: a new Norfolk species. *Trans. Norfolk Norwich Nat. Soc.* **24**(2), 75-77.

LOUSELEY, J. E. 1976 *Flora of Surrey*. Newton Abbot: David & Charles.

NICHOLSON, W. A. 1914 *Flora of Norfolk*. London: West, Newman & Co.

PERRING, F. H. & WALTERS, S. M. (Eds) 1962 *Atlas of the British Flora*. London: Thomas Nelson for Botanical Society of the British Isles.

PETCH, C. P. 1933 The vegetation of St. Kilda. *J. Ecol.* **21**, 92-100.

PETCH, C. P. 1986 Matted sea lavender, *Limonium bellidifolium*, in West Norfolk. *Trans. Norfolk Norwich Nat. Soc.* **27**(3), 190-192.

PETCH, C. P. & SWANN, E. L. 1962 West Norfolk plants today. Supplement to *Proc. Bot. Soc. Brit. Isles* **4**(4), v-xiii, 1-89.

PETCH, C. P. & SWANN, E. L. 1968 *Flora of Norfolk*. Norwich: Jarrold.

SWANN, E. L. 1953 A new plant for Norfolk. *Trans. Norfolk Norwich Nat. Soc.* **17**(4), 298-300 [Epilobium adenocaulon].

SWANN, E. L. 1975 Supplement to the Flora of Norfolk. Norwich: F. Crowe & Sons.

SWANN, E. L. 1977 Presidential Address 1976: Norfolk and botany. *Watsonia* **11**(3), 189-194.

SWANN, E. L. 1982 Norfolk bryophytes today. *J. Bryology* **12**, 77-112

SWANN, E. L. 1984 *The Flora of Stanford Training Area*. Unpublished report.

TRIST, P. J. O. (Ed.) 1979 *An Ecological Flora of Breckland*. Wakefield: EP Publishing Ltd.

DITCH-FLORA OF THE HALVERGATE MARSHES

Neil D. Burgess and Ceri E. Evans

Royal Society for the Protection of Birds, The Lodge, Sandy, Bedfordshire, SG19 2DL

Abstract

Ditch-plant assemblages were investigated from 150 ditches forming a north-east to south-west section across the Halvergate Marshes adjacent to the tidal Breydon Water and river Yare. Assemblages of ditch-plants were defined by the multivariate statistical program TWINSPAN. The ditch-groups formed a north-east to south-west zonation across the marshes, largely controlled by a decreasing conductivity gradient (probably largely salinity) of the ditch water east to west, although water width, water depth, bank height, grazing pressure, degree of poaching and length of time from last clearance may also be important. Statistically defined ditch plant groups were related to published swamp and aquatic plant communities, and a high level of similarity between the vegetation groupings at Halvergate and those of other studies was demonstrated.

Introduction

The Halvergate Marshes are the largest coastal grazing marsh in Britain, comprising some 4,000 hectares of grassland intersected by ditches. Until the 12th century

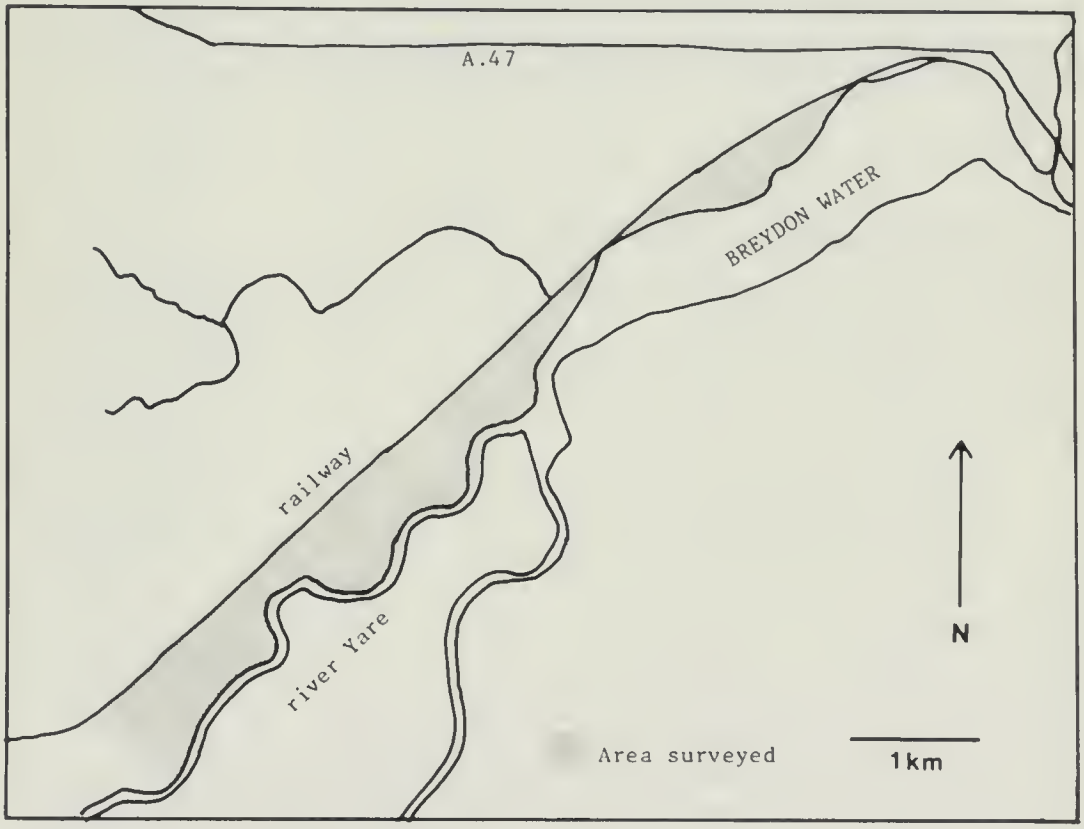


Fig. 1. Map showing extent of survey area.

they were an ancient estuary termed Gariensis (see Talks, A. 1986). A spit then formed across the outlet which caused the estuary to silt up, permitting extensive saltmarshes to develop. This saltmarsh was gradually enclosed and converted to grassland, with intersecting ditches constructed to drain the land and function as 'wet fences'. As these ditches have been kept permanently full of water a 'natural' ditch-flora has developed over the past 800 years, its species-composition controlled by the chemistry of the ditch-water, the profile and management of the ditches, and the grazing of the surrounding grassland.

Considering the size of these marshes and their position in the Norfolk Broads area surprisingly little work has been published on the ditch-plant flora (Driscoll, 1983; Talks, L., 1986). In this paper results are presented of an investigation conducted in summer 1987 (Burgess, 1988) and summer 1988 on the ditch-plant assemblages from a section of the marshes between Great Yarmouth and Reedham (Figure 1).

Methods

The standard methodology of Alcock and Palmer (1985) was used to collect quantitative data on the ditch-plants growing in a representative 20m section of each ditch. Within this section all plant species were identified and their percentage cover of the ditch assessed. Other features of the ditches, such as water width, water depth, bank height, bank width and bank angle were also recorded.

Ditch-plant assemblages were classified using TWINSPAN, a FORTRAN program (Hill, 1979). This was chosen because of its ability to classify ditch vegetation (Charman *et al.*, 1985; Driscoll, 1983, 1986; Talks L., 1986; Wolseley *et al.*, 1984).

Conductivity readings were taken over the whole of the surveyed area in late August 1988 using a pHOX Series 52 portable conductivity meter.

Table 1. Species diversity in ditch-groups A—H

	A	B	C	D	E	F	G	H
Total species	52	36	40	32	30	30	23	34
Mean	14.4	12.6	12.7	9.6	10.6	11.25	8.1	8.4
Range	9-30	8-17	7-20	6-15	6-16	8-13	6-10	4-13
Emergent (out of 44)	31	21	18	16	15	17	19	18
Submerged (out of 10)	6	7	8	5	5	5	7	6
Floating (out of 4)	4	3	3	2	2	2	2	2
Number of ditches	10	15	39	25	13	17	10	21

Table 2. The ditch-plant associations delimited by TWINSPAN: species composition, constancy and mean cover values.

	Species \ Ditch-groups	A	B	C	D	E	F	G	H
F	Hydrocharis morsus-ranae	II (3)	I (1)	I (1)	—	—	—	—	—
F	Potamogeton crispus	I (1)	—	I (1)	—	—	—	—	—
F	Myosotis scorpioides	I (1)	—	—	—	—	—	—	—
F	Cardamine pratensis	I (1)	—	—	—	—	—	—	—
F	Hottonia palustris	I (1)	—	—	—	—	—	—	—
F	Sagittaria sagittifolia	I (1)	—	—	—	—	—	—	—
F	Polygonum amphibium	I (1)	—	—	—	—	—	—	—
F	Eupatorium cannabinum	I (3)	—	—	—	—	—	—	—
F	Symphytum officinale	I (2)	—	—	—	—	—	—	—
F	Rumex hydrolapathum	III (2)	I (1)	—	—	—	—	—	—
F	Sparganium erectum	II (3)	I (1)	—	—	—	—	—	—
F	Mentha aquatica	I (1)	—	—	—	—	—	—	—
F	Juncus inflexus	III (2)	1 (2)	—	—	—	—	—	—
F	Juncus effusus	I (2)	—	—	—	—	—	—	—
F	Iris pseudacorus	I (2)	—	—	—	—	—	—	—
F	Alisma plantago-aquatica	I (1)	—	—	—	—	—	—	—
F	Carex riparia	V (4)	I (1)	—	—	—	—	—	—
F	Chara sp.	I (1)	II (2)	—	—	—	—	—	—
F	Glyceria maxima	IV (2)	III (2)	—	—	—	—	—	—
F/B	Glyceria fluitans	III (2)	IV (2)	—	—	—	—	—	—
F	Juncus articulatus	II (2)	II (2)	—	—	—	—	—	—
F	Ranunculus circinatus	I (1)	I (2)	I (1)	—	—	—	—	—
F	Nasturtium officinale	II (2)	II (2)	I (1)	—	—	—	—	—
F	Apium nodiflorum	I (1)	—	I (1)	—	—	—	—	—
F	Oenanthe fistulosa	II (2)	V (2)	IV (1)	I (1)	I (1)	II (1)	—	I (1)
F	Berula erecta	IV (2)	IV (1)	II (2)	I (1)	—	—	I (1)	—
F	Callitriche spp.	I (1)	I (1)	II (1)	1 (1)	—	—	—	—
F	Eleocharis palustris	I (2)	IV (3)	IV (3)	1 (1)	I (2)	II (3)	I (1)	—
F/B	Enteromorpha sp.	IV (4)	V (5)	V (4)	III (3)	V (4)	IV (4)	—	II (2)
F/B	Scirpus lacustris ssp. tabernaemontani	I (2)	I (1)	II (1)	I (2)	I (1)	—	—	—
F	Lemna minor/gibba	IV (2)	III (2)	III (2)	III (2)	III (1)	II (1)	—	I (1)
F	Carex otrubae	II (1)	I (2)	I (1)	II (2)	I (1)	I (1)	—	—
F/B	Triglochin palustris	I (1)	III (2)	IV (2)	I (1)	III (2)	III (2)	—	II (1)
F/B	Ranunculus sceleratus	III (1)	III (1)	III (1)	II (1)	II (2)	III (2)	I (2)	II (2)
F/B	Phragmites australis	III (2)	V (3)	V (4)	V (5)	V (4)	V (3)	V (5)	V (3)
F/B	Ceratophyllum demersum	I (1)	I (1)	II (1)	I (1)	IV (3)	III (3)	II (1)	—
F/B	Agrostis stolonifera	IV (2)	V (3)	V (4)	V (2)	V (2)	V (3)	V (2)	V (4)
F/B	Hippuris vulgaris	—	I (1)	III (1)	I (2)	I (1)	I (4)	I (1)	—
F	Rumex conglomeratus	II (1)	II (1)	I (1)	II (1)	I (1)	—	—	—
F/B	Lemna trisulca	I (1)	II (2)	IV (4)	V (4)	V (5)	IV (4)	IV (4)	I (1)
F	Rumex palustris	—	—	I (1)	—	I (1)	—	—	—
B	Althaea officinalis	—	—	—	I (1)	—	—	I (1)	—
B	Scirpus maritimus	I (1)	III (2)	IV (2)	III (2)	IV (3)	III (2)	III (2)	IV (3)
F/B	Myriophyllum spicatum	I (1)	I (1)	II (1)	III (1)	IV (3)	V (5)	II (4)	II (2)
F/B	Alopecurus geniculatus	I (1)	I (1)	II (2)	I (1)	III (2)	II (2)	—	I (2)
F/B	Potamogeton pectinatus	—	I (1)	III (2)	III (1)	V (4)	V (3)	V (4)	III (4)
B	Apium graveolens	—	—	I (1)	II (1)	I (1)	I (1)	II (1)	II (1)
B	Juncus gerardii	—	—	II (1)	III (2)	I (1)	III (2)	I (1)	V (2)
S	Puccinellia maritima	—	—	—	—	—	—	—	I (2)
S	Spergularia marina	—	—	—	—	—	—	—	I (1)
S	Parapholis strigosa	—	—	—	—	—	I (1)	—	I (1)
S	Puccinellia rupestris	—	—	—	—	—	I (1)	—	I (1)
S	Plantago maritima	—	—	—	—	—	—	—	I (1)
F/B	Potamogeton pusillus	—	—	—	—	I (1)	I (1)	—	II (3)
S	Triglochin maritima	—	—	—	—	—	I (1)	—	I (1)
S	Puccinellia distans	—	—	—	—	—	I (1)	I (1)	II (1)
S	Glaux maritima	—	—	—	—	—	—	—	II (1)
S	Aster tripolium	—	—	—	—	—	I (1)	—	II (1)
F/B	Zannichellia palustris	—	I (1)	I (1)	I (1)	—	II (3)	—	II (2)
B	Ranunclus baudotii	—	—	—	I (1)	I (1)	II (1)	—	II (2)
	Number of ditches	10	15	39	25	13	17	10	21

Roman numerals denote percentage occurrence (constancy) of species in each ditch-group. I = 1-20%; II = 21-40%; III = 41-60%; IV = 61-80%; V = 81-100%.
Numbers (in parenthesis) denote the mean cover value (as assessed from DOMIN scale and rounded up): 1 = <4% cover; 2 = 4-10%; 3 = 11-25%; 4= 26-33%; 5 = 33-50%.
F = freshwater species; B= brackish water species; F/B = freshwater or brackish species; S = saltmarsh species (assessments from Clapham et al., 1987).

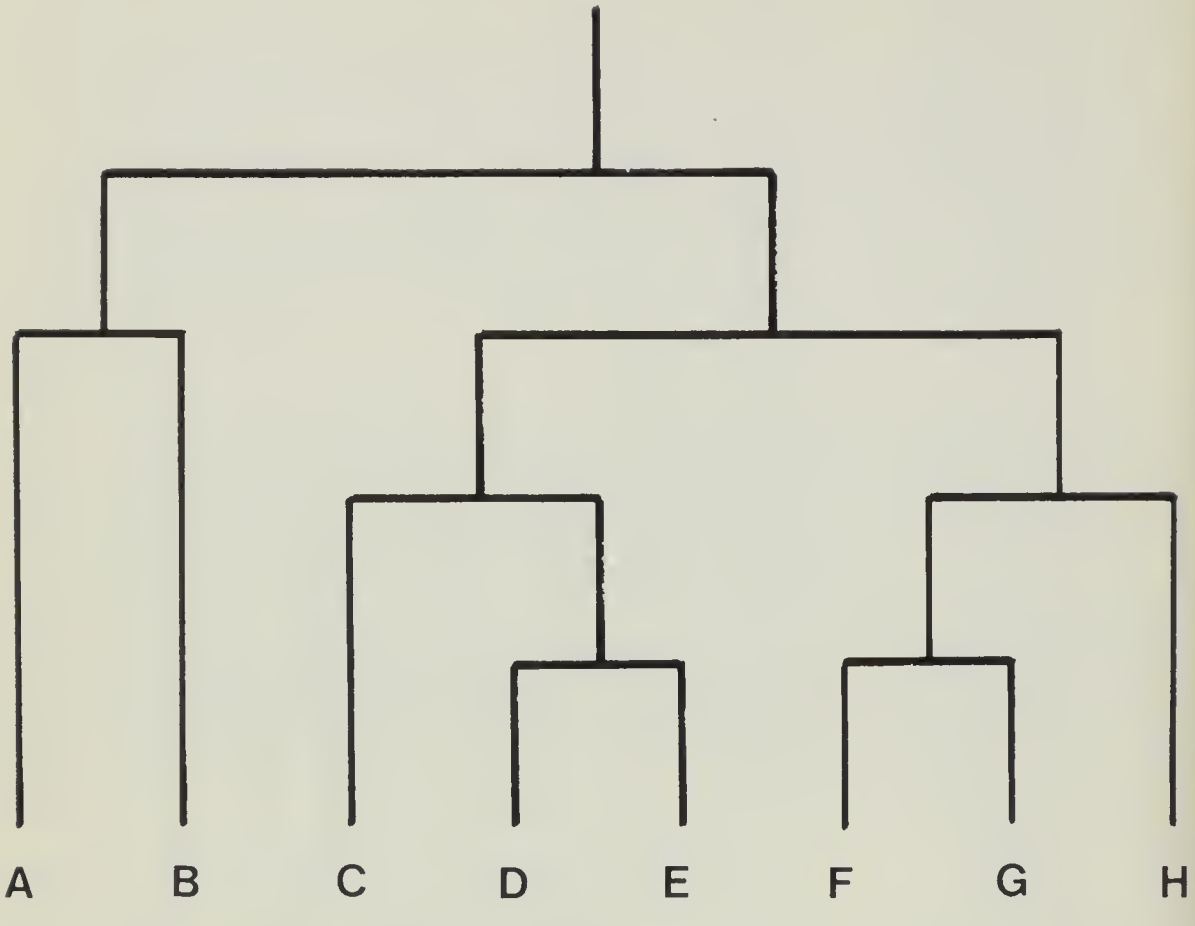


Fig. 2. Dendrogram showing relationship of TWINSPAN ditch-groups

Results

The TWINSPAN analysis separated 8 groups of ditch plant (Figure 2). Further details on the description of these communities may be found in Burgess (1988).

Table 1 presents species diversity in ditch-groups A to H. Diversity declines from A to H, although there are no statistically significant differences between adjacent groups.

The composition and frequency of occurrence of plants in the various ditch-groups are presented in Table 2. This Table also assesses the distribution of freshwater, brackish-water tolerant and saltmarsh plants in the ditch-groups (as assessed from Clapham *et al.*, 1987).

It is evident that groups A and B support mainly freshwater species, whereas groups C to H support increasing numbers of brackish water tolerant and saltmarsh species.

Water conductivity data for all the ditch-groups are presented in Table 3.

Table 3. Conductivity (microsiemens per cm at 25°C) in water of ditch-groups A—H

Ditch-group	A	B	C	D,E	F,G	H
Mean conductivity (uS)	1330	2700	5500	11750	10160	8240
Range	800-2300	500-3000	2400-6500	2000-22000	2000-24000	2000-12000
Number of ditches	10	15	39	38	27	21

Table 4. Physical data for ditch-groups A—H

Ditch-groups	A	B	C	D	E	F	G	H
Mean Water width (m)	4.2	3.7	2.8	2.8	3.7	3.6	4.9	4.14
range (m)	1.8-6.5	1.6-5.0	1.8-4.0	1.6-4.5	1.6-5.0	1.8-5.0	1.8-6.5	3-7
Mean bank width (m)	0.9	1.0	0.96	0.97	1.0	0.98	0.86	1.0
range (m)	0.2-1.5	0.35-1.5	0.6-1.5	0.4-1.5	0.6-1.5	0.6-1.5	0.2-1.5	0.7-2.0
Mean water depth (m)	0.9	0.87	0.64	0.64	0.87	0.83	1.0	0.72
range (m)	0.2-1.5	0.5-1.1	0.5-1.3	0.3-1.3	0.65-1.1	0.6-1.2	0.4-1.5	0.2-1.5
Mean bank height (m)	0.72	0.77	0.76	0.75	0.77	0.94	0.68	0.86
range (m)	0.35-1.2	0.4-1.2	0.5-1.2	0.4-1.2	0.5-1.2	0.7-1.2	0.4-1.2	0.4-1.2
Mean Bank A (0)	48	47	45	44.8	45	43.3	48	44
range (0)	35-80	35-70	35-70	30-70	20-70	30-45	30-80	20-85
Mean Bank B (0)	47	44.2	43	42.8	41.9	45	48	44.7
range (0)	35-80	35-70	35-70	30-70	20-70	-	30-90	20-85
Number of dykes	10	15	39	25	13	10	17	21

Bank A = north/east bank; Bank B = south/west bank

Analysis of variance revealed that the water conductivity was significantly different between groups ($p < 0.001$). A Tukey Q Test further showed that the water conductivities in groups D/E and F/G were significantly higher than in the other groups ($p < 0.05$). No measurements were made of conductivity in the ditch bank soil.

The important physical parameters of the ditches within the various ditch-groups are presented in Table 4.

Analysis of variance has revealed that the water width is statistically different between groups ($p < 0.001$). A Tukey Q Test has further shown that the water in group D was significantly narrower than in all other groups ($p < 0.05$).

Analysis of variance has revealed that the water depths are statistically different between the groups ($p = 0.05$). The Tukey Q Test showed that the water in group D is significantly shallower than in all other groups ($p < 0.05$), and that the water in group G is significantly deeper than in all other groups ($p < 0.05$).

Analysis of variance has also revealed that the bank heights between the groups are significantly different ($p < 0.05$). However the Tukey Q Test did not show that the bank height in any ditch-group was significantly different from any other, probably because this is a highly stringent statistical test.

Analysis of variance showed no statistical difference between either the width, or bank angle A and B between the groups.

The ditch-groups recognised from the TWINSPAN analysis, and their relationships are presented in Figure 2.

The importance of the increased conductivity of the ditch-water from groups A to H in controlling the splits in the assemblage data can be clearly seen, with the physical factors being of lesser importance. Those environmental parameters which may define splits in the flora between the various ditch-groups are summarised in Table 5.

Table 5. Environmental parameters believed to be controlling species-composition of ditch-groups A—H.

Ditch-groups	Conductivity (uS p.cm)	Water width (m)	Water depth (m)
A	up to 1330		
B	1330-2700		
C	2700-5500		
D	5500-11750*	<2.8*	<0.64*
E	5500-11750*		
F	11750-10160*		
G	11750-10160*		>0.9*
H	10160-8240		

* Statistically significant difference (Tukey Q Test)Z

Relation of ditch-groups to swamp and aquatic plant classifications

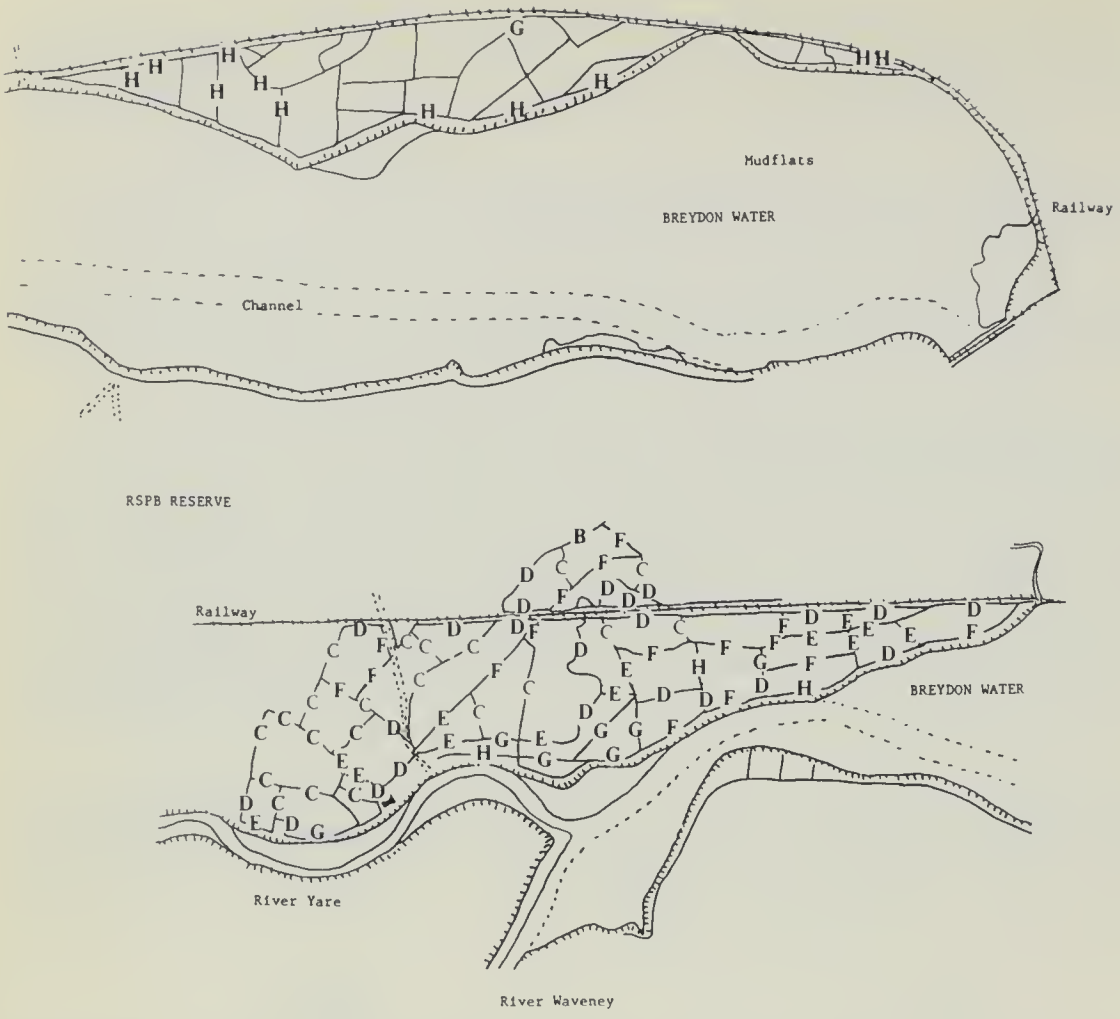
In this section the relationship of the ditch-plant assemblages recognised here to National Vegetation Classification swamp communities (Rodwell, 1984), and aquatic plant assemblages defined in the National Vegetation Classification (Rodwell, 1990) and Somerset Levels and Moors (Wolseley *et al.*, 1984) is assessed (Table 6). These assessments were made from the summed emergent, floating and submerged species data for all ditches. Hence it is the overriding influence of one community in a ditch-plant group which has allowed its assignation to a particular community. Within a ditch-plant group there may be several NVC or aquatic plant communities represented as minor components, even so it appears that the ditch-plant assemblages recognised in this study can be equated to vegetation groupings of other studies.

Environmental distribution of swamp communities

The National Vegetation Classification (NVC) *Glyceria maxima* swamp community and the *Carex riparia* swamp community are both indicative of eutrophic fresh water (Rodwell, 1984) and were found in such locations during this survey. The *Eleocharis palustris* swamp community can be found both in freshwater and brackish conditions (Rodwell, 1984). At Halvergate it occurs in brackish areas and appears to represent a stand of the nationally scarce *Agrostis stolonifera* sub-community of this community (Rodwell, 1984). The *Phragmites australis* swamp community can also occur in both freshwater and brackish areas but on the study area was mostly

Table 6. Putative relationship of ditch-groups to National Vegetation Classification (NVC) swamp communities, and aquatic plant assemblages of Driscoll (1983), Charman et al. (1985) and de Lange (1972)

	Swamp communities	Aquatic communities	
Ditch-group	NVC Community (Rodwell, 1984)	NVC Community (Rodwell, 1989)	Wolseley et al., (1984)
A-B	Glyceria maxima swamp (S5) Carex riparia swamp (S6)		
C	Eleocharis palustris swamp (S19)		
D			Lemna trisulca
E	Phragmites australis swamp (S4)		
F		Potamogeton pectinatus Myriophyllum spicatum community (A11)	
G	Phragmites australis swamp (S4)		
H	Scirpus maritimus swamp (S21)		


Mudflats
BREYDON WATER
Railway
Channel
RSPB RESERVE
Railway
BREYDON WATER
River Yare
River Waveney
REEDHAM MARSHES
River Yare
N
1 km

growing in water with a high conductivity which was probably brackish. The *Scirpus maritimus* swamp community is indicative of brackish conditions (Rodwell, 1984), and at Halvergate the best development of the community occurred in water with a high conductivity adjacent to the tidal Breydon Water and River Yare.

Environmental distribution of aquatic floras

Ditch-plant assemblages dominated by the aquatic species *Myriophyllum spicatum* and *Potamogeton pectinatus* have been previously recorded in brackish water conditions to the south-west of Breydon Water (Driscoll, 1983). Furthermore, Charman et al. (1985) recovered a similar assemblage from brackish ditches on the North Kent Marshes, and de Lange (1972) regards the assemblage as indicating brackish conditions in the Netherlands. On Halvergate this assemblage was recovered from similar high conductivity (probably brackish) areas.

A ditch-plant assemblage dominated by *Lemna trisulca* has been previously reported from the Somerset Levels and Moors (Wolseley *et al.*, 1984) where it generally co-occurs with *Hydrocharis morsus-ranae* in species-rich ditches. At Halvergate the ditch-plant assemblage typified by this species is species-poor (Table 1), and occupies high conductivity water (Table 3), although the conductivity is lower than in ditches supporting the *Myriophyllum-Potamogeton* assemblage.

Management effects

Ditches: Ditch management over the whole of the surveyed area is similar. Internal Drainage Board ditches (generally the widest ditches recorded in this survey) are cleared out with a mechanical digger about once every 10 years, whereas the other ditches are cleared out every 15-25 years (Street, pers. comm.). Hence ditch management regimes probably have little effect on the species composition of the various ditch-groups. The only instance where management may define a ditch-group is the *Phragmites australis* dominated shallow and narrow ditches of ditch-group D. These ditches are mostly located alongside the railway, where they have not been cleared out for many years, and are therefore shallow (Table 4).

Grazing: The grazing regimes over the whole of the area surveyed are similar (Street, pers. comm.), hence grazing has probably not affected the composition of the ditch-plant assemblages. Inaccessable ditches, including those adjacent to the railway are less intensively grazed and this has probaly assisted the spread of *Phragmites*.

Floral zonation

Plotting the TWINSPAN groups on a map of the area surveyed has revealed a floral zonation (Figure 3). Ditch-groups A to H generally progress south-west to north-east across the study area, with the zones occupied by groups B and C on the Reedham Marshes, and group H around Breydon Water being particularly well defined. In addition, the majority of ditch-group D is found alongside the railway.

This zonation appears to be primarily controlled by the increasing ditch-water conductivity from the north-east to the south-west, which probably equates with a salinity gradient, although data on other conductivity increasing ions such as calcium, magnesium etc. were not collected. The increasing width of the water in the ditches in the south-eastern section, especially close to the seawall, and perhaps increased salt-water seepage into the soil creating hypersaline conditions adjacent to the seawalls are also probably important in defining some parts of the zonation.

Conservation evaluation

Brackish-water systems are resticted in occurrence nationally. Those at Halvergate are not as noteworthy as the brackish grazing marsh ditches in Essex and on the North Norfolk Coast (Leach, pers. comm.), but they do represent a large block of an otherwise nationally scarce resource, and hence have some national importance.

Acknowledgements

This work formed part of a botanical survey of the RSPB Berney Marshes reserve. Thanks are extended to Les and Sheila Street for their help throughout the field season, and to M. Palmer, S. Leach, S. Reid and R. Driscoll for improving comments on an earlier draft.

References

ALCOCK, M.R. and PALMER, M.A. 1985. A standard method for the survey of ditch vegetation. *Nature Conservancy Council CST notes* no.**37**.

BURGESS, N.D. 1988. *Berney Marshes Reserve: vegetation survey, botanical site evaluation and management prescriptions*. Unpublished RSPB vegetation survey.

CLAPHAM, A.R., TUTIN, T.G. and MOORE, D.M. 1987. *Flora of the British Isles*. Third edition. Cambridge: Cambridge University Press.

CHARMAN, K., PALMER, M. and PHILP, E.G. 1985. Survey of aquatic habitats in the North Kent Marshes. *Trans. Kent Field Club* **10**, 19-32.

DRISCOLL, R.J. 1983. A preliminary classification of Broadland dyke vegetation using TWINSPAN. *Nature Conservancy Council CST notes* no.**35**.

DRISCOLL, R.J. 1986. The dyke vegetation at Holkham National Nature Reserve, Norfolk. *Trans. Norfolk Norwich Nat. Soc.* **27**, 183-190.

HILL, M.O. 1979. *TWINSPAN—a FORTRAN program for arranging multivariate data in an ordered two-way table by classification of the individuals and attributes*. New York: Cornell University Press.

DE LANGE, L. 1972. *An Ecological Study of Ditch Vegetation in the Netherlands*. Amsterdam.

RODWELL, J. 1984. *National Vegetation Classification: Swamps and tall-herb fens*. University of Lancaster. Unpublished report to NCC.

RODWELL, J. 1989 *National Vegetation Classification: Aquatic communities*. University of Lancaster. Unpublished report to NCC.

TALKS, A. 1986. *Changing land use on the Halvergate Marshes: the conservation of an area of traditional grazing marshes*. Geography BSc dissertation, Durham University.

TALKS, L. 1986. *A study of the factors which affect the distribution of vegetation in the Halvergate Fleet dyke*. Botany BSc dissertation, Durham University.

WOLSELEY, P.A., PALMER, M.A. and WILLIAMS, R. 1984. The aquatic flora of the Somerset Levels and Moors. *Nature Conservancy Council. CST report* no: **545**.

PLANT NOTES 1989

Gillian Beckett

Bramley Cottage, Stanhoe, Kings Lynn, PE31 8QF

Alec Bull

Hillcrest, East Tuddenham, Dereham, NR20 3JJ

The pigweeds (*Amaranthus*) have been much in evidence during the hot summer of 1989. The genus as a whole is mainly native to North America and its members are usually considered as causals. Three species appeared on a roadside at Ellingham near Bungay. If conditions are suitable, the site should be searched again in future years, as hot dry conditions ought to have enabled them to set viable seed. In Breckland, there are already two long established colonies which have been watched over by Jean Gaffney of Swaffham. A colony first found by her at Weeting, is still there in good quantity in 1989, and a second at Cockley Cley which had been

discovered in 1976, had *Amaranthus bouchonii* as almost the dominant plant over a whole field. This species is unknown in the wild, but is very close to *A. hybridus*, the difference lying in the seed. With *A. bouchonii* the fruits remain whole until they decay, whereas *A. hybridus* fruits split transversely rather like the lid coming off a mustard pot. Other west Norfolk records of *Amaranthus* come from Feltwell, Pentney and Lynn.

Pheasant feed was probably the source of ragweed *Ambrosia artemisifolia* and several different forms of *Ipomoea hederacea* at Shouldham. The rare 'longleaf' *Falcaria vulgaris* was found at North Elmham and a colony of the Fyfield pea, *Lathyrus tuberosus* at Feltwell. Many introductions included in the list, were noted round towns and the City of Norwich, but one of the more spectacular rural records was of the so called 'Indian mallow' *Abutilon theophrasti*. Five plants averaging four feet or more in height were discovered in a mangold field at Saxthorpe. (I didn't realise people still grew mangolds!—ALB)

Among native species, the discovery of *Thesium humifusum* in NW Norfolk must stand out as the best find of the year, as it was believed to be extinct in the county. It was found by members of the Mid-Norfolk Group of the Norfolk Naturalists Trust, while on an excursion to North Elmham. An interesting discovery in the east of the county was herb-paris *Paris quadrifolia* in woods at Metton. This is well outside the normal range of that plant in the county, though there was an old record for Weybourne Springs which no longer exist. At Beeston Bog, the invasive *Crassula helmsii* was present in a large patch in a dew pond that had been excavated just a year or two previously. Elsewhere in the country, this species has shown the potential to take over desirable wetland niches, but steps have been taken to make sure that this does not happen at Beeston.

The importance of watching areas of the countryside which are subjected to unusual activities cannot be over-emphasised. Peter Lambley contacted ALB during the summer, following a walk over some heaps of topsoil removed from a new area of gravel extraction at Sparham, where he had found Venus's-looking glass *Legousia hybrida* abundant and with good quantities of small toadflax *Chaenorhinum minus*, fluellen *Kickxia elatine* and night-flowering campion *Silene noctiflora*. I subsequently visited the area and added *Polygonum rurivagum*. Several plants of this rare knotgrass were found. This is the first for East Norfolk in a 'wild' situation, though ETD found it a number of years ago on Harford Tip.

On the bramble front, having discovered a plant on the BSBI Devon meeting in July which I considered to be identical to *Rubus britannicus* which I had had confirmed by Alan Newton for me from a south Essex gathering, I collected all my 'close to *R. britannicus*' sheets together and sent them to Alan, who replied that all were in fact *R. britannicus*. This extends the range of that species into west Norfolk, as I have confirmed sheets collected in 1981 at Great Carr, West Tofts, and by the trackside in Lynford Arboretum.

East Norfolk is now joining with the west in an 'all out' tetrad flora. Recording continues in the west, with dwarf gorse *Ulex gallii* being recorded more frequently than was expected though all sites are within twenty miles of the coast, with the polypodies *Polypodium vulgare* and *P. interjectum* appearing to have a somewhat similar distribution, possibly because they are the least hardy of our common ferns. As we are only about to start in the east, we need every record we can get. Please keep sending in records of everything from West Norfolk including the daisies and dandelions. That applies in the east as well!

The classified records which follow include the more interesting of the casuals, some of which may become established if we really are going to have a climatic change due to the greenhouse effect, and also a number of plants which have been grown in cultivation of some sort and are escaping back into the wild in areas where they are rare or absent. These may well spread more readily than the aliens.

Nomenclature in these notes follows Clapham, Tutin and Warburg (1985)

Abutilon theophrasti TG13 five plants in mangold field, Saxthorpe MAB
Acorus calamus TG20 large colony in river, Thorpe St. Andrew ETD
Amaranthus blitoides TM39 roadside near Ellingham Mill A. Ebrehart comm. ETD
Amaranthus bouchonii TL78 Weeting for more than 20 years; TF70 Cockley Cley, dominant in field in 1989 where it has been known since 1976 JG; TL68 Feltwell RT; TF71 Pentney HW; TF61 Kings Lynn HW
Ambrosia artemisifolia TF61 Shouldham GM
Amsinckia intermedia TG20 waste area near King Street, Norwich ETD
Aucuba japonica TG20 five seedling bushes in a 'wild type' habitat at two sites in Norwich. This 'laurel' very rarely establishes itself in Britain ETD
Barbarea intermedia TG30 Brundall marina extension SP
Barbarea stricta TG20 flowering on an old wooden stake in the river in Norwich, and in a similar situation at Thorpe, where they have been for several years ETD
Bidens cernua var *radiatus* TG30 abundant RSPB Surlingham marsh ETD
Brassica juncea TG20 Norwich inner ring road. More than 80 plants mainly on S/SW side ETD (That which fell off a lorry!)
Callitriche platycarpa TG04 abundant in dykes, Cley NNT Reserve ETD
Calystegia sepium TG30 colony at Surlingham Marsh RSPB reserve with pink flowers ETD
Camelina sativa TG30 colony in grounds of Brundall memorial hall SP
Campanula latifolia TG12 Booton Common, found during a NNT study visit, comm. SP
C. rapunculoides TG20 scattered plants in Rosary Road Cemetery ETD
C. trachelium TG20 churchyard wall, central Norwich ETD
Cannabis sativa TM29 Morningthorpe Tip GM
Chenopodium bonus henricus TG20 St. Andrews hospital Thorpe SP; TG21 Wroxham Rd. Coltishall, large colony RML
C.polyspermum TG12 roadside verge Blickling ETD
Chrysanthemum maximum TG20 waste ground, large long-established colony ETD (This species grows abundantly on cliff falls in the Overstrand area. ALB)
Citrullus lanatus water melon TM29 Morningthorpe Tip. (Greenhouse effect?) GM
Clematis targuticus TG20 flowering seedling in rough grass 70 yards from parent plant; also recorded as naturalised in Cornwall ETD
Coronilla varia TG20 large plant flowering in gravel area, central Norwich ETD
Cotoneaster franchetti TG20 pavement weed, Norwich ETD
C. × *watereri* TG20 growing on walls in central Norwich ETD
Crassula helmsii TG14 dug pond, Beeston Bog David Mower
Crocus purpureus & *C. tommasinianus* both species persisting and increasing in their two 'wild' sites in the city ETD
Cucumis melo & *C. sativa* TM29 Ordinary melons and cucumbers also did well at Morningthorpe Tip GM
Cyclamen hederifolium abundantly naturalised at Reymerston TG00 Ditchingham

TM39 and Blickling TG12 ETD
Dactylorhiza incarnata ssp. *coccinea* TG24 several colonies in wet flushes at the base of the undercliff between Cromer and Overstrand RML (det. I. Denholm, 1990)
Diplotaxis tenuifolia TG20 still persists in Westwick Street, where it has been known for 35 years ETD
Dryopteris pseudo-mas TG20 Laws Wood Thorpe; TG21 Beeston Springs SP
Echinochloa colonum TM29 Morningthorpe Tip GM
Elodea nuttallii TG20 abundant in river at Norwich ETD
Erucastrum gallicum TM39 Ellingham near the grain store. This plant naturalises, and is new to east Norfolk (GM conf. Dr. T. Rich)
Euphorbia cyparissias TG20 growing on wall in central Norwich graveyard ETD
Falcaria vulgaris TF91 North Elmham D. Mathias
Galega officinalis TG20 fifteen plants on Harford Tip where it has persisted for some years ETD
Galinsoga ciliata TM39 abundant in a lorry park at Ellingham ETD
Geranium lucidum & *G. rotundifolium* TG20 four of the first named, the second frequent on a disused railway track near Hall Road, Norwich ETD
G. pratense TG20 Harford Tip, common and spreading along the edge of the area, several white flowered, has been there since at least 1975 ETD
Groenlandia densa TG04 roadside ditch, Cley reserve ETD
Hebe stricta (*Hebe salicifolia* agg) TG20 one plant grown on for certain naming, many self-sown on wall in Norwich ETD
Heracleum mantegazzianum TG20 self-sown plant near Norwich city centre ETD
Hieracium aurantiacum TG20 Rosary Road Cemetery 75 flowerspikes, spreading ETD
H. brunneocroceum TF93 road bank at Great Snoring ETD
H. umbellatum TG42 remarkably abundant in dunes, Winterton to Waxham RML
Hirschfeldia incan TM29 Morningthorpe tip where it will no doubt persist GM
Hyacinthus hispanicus TG20 disused railway track near Hall Road ETD
Hypericum androsaemum TG20 abundant seedlings in graveyard in central Norwich ETD
Iberis umbellata TG20 19 plants found among cobblestones Norwich ETD
Impatiens parviflora TG12 a colony of white-flowered plants among normal ones, Blickling ETD
Ipomea hederacea TF61 Shouldham, several different forms, presumed pheasant feed alien GM
Lamium maculatum TG20 graveyard in central Norwich. This plant naturalises frequently ETD
Lathyrus tuberosus TL79 Feltwell RT
Legousia hybrida TG01 Sparham, frequent on spoil heap of topsoil PWL
Leucojum aestivum TG10 Cringleford, two plants on river bank and one on open marsh, apparently seedlings from the known site at Harmers Wood on the opposite bank of the river ETD
Lobelia erinus TG20 frequent as a pavement weed in Norwich during 1989 ETD (and in other towns thoughout the region ALB)
Lunaria annua TG20 Norwich, seedlings throughout the city ETD; (this plant is to be found widely outside the city as well ALB)
Melissa officinalis TG20 Norwich, seedlings found in pavements in two widely separated areas of the city. ETD

Misopates orontium TG20 Thorpe St. Andrew. SP
Myosotis sylvatica TG20 central Norwich graveyard ETD
Myosurus minimus TM39 still persisting at Geldeston GM
Myrrhis odorata TG20 Three self-sown in pavements in city centre have been there for several years ETD
Ornithogalum umbellatum TG20 Norwich, a fine display persisting in an asphalted car park in Cathedral Close ETD
Oxalis europaea var *rufa* TG20 graveyard in central Norwich, on wall ETD
Panicum miliaceum TM29 Morningthorpe Tip GM
Papaver atlanticum TG20 in at least six areas of rough grass, spreading in Norwich ETD
Paris quadrifolia TG23 Metton Woods, five plants KC Durrant comm. ETD
Platanus × *hybrida* TG20 one two foot high seedling near parent, waste land near Norwich city centre ETD
Polygonum rurivagum TG01 Sparham, on spoil heap of topsoil, several plants. ALB
Polypogon monspeliensis TG30 still abundant at Cantley beet factory RML
Potentilla anglica TG20 one large flowering plant in rough grass near Norfolk and Norwich hospital ETD
Rubus britannicus TL89 1981 colonies at Great Carr, West Tofts, and Lynford Arboretum ALB
Sambucus nigra TG20 on city waste area, a striking bush, all the flowers being edged with purple ETD
Scandix pecten-veneris TM29 frequent in a field at Woodton GM
Scrophularia vernalis TF94 still present at Stiffkey, it's *locus classicus*, where it was first recorded in the wild in 1805 RML
Sedum dasyphyllum TG20 in vast quantity in gravel near city centre. This plant naturalises very readily ETD
Setaria italica and *S. viridis* TM29 Morningthorpe Tip GM
Silene dioica TG23 Metton Woods, with white flowers ETD
S. noctiflora TG30 Strumpshaw RSPB reserve SP; TG01 top soil heap, Sparham PWL
S. gallica TG30 Strumpshaw RSPB reserve SP
Sison amomum TG30 Strumpshaw SP. This is one of the declining natives which we must keep a special lookout for during the Flora survey.
Sisymbrium altissimum TG30 several plants at Cantley beet factory RML
Stellaria pallida TG20 frequent in two areas of trampled grass near river in Norwich ETD
Thesium humifusum TF91 North Elmham NNT Mid-Norfolk Group field meeting
Tulipa gesnerana TG20 several scattered plants along disused railway track near Hall Road ETD
Verbascum blattaria TM39 one plant in lorry park at Ellingham ETD
Verbascum phlomoides TG20 still in quantity at Harford Tip where it has been since 1975 ETD
Veronica filiformis TG20 spreading widely in lawns and grass verges throughout the city ETD
Zannichellia palustris TG01 East Tuddenham, still persisting in cattle drinking tank approximately ten years after the cessation of pumping water from the river Tud as the water source. (Since then the tank has been filled from a deep bore ALB)

List of contributors:- MAB, Mrs M.A. Brewster; ALB, A.L. Bull; ETD, E.T. Daniels; JG, Jean Gaffney; PWL, P.W. Lambley; RML, Dr R.M. Leaney; GM, George Maybury; SP, Shane Plant; RT, Richard Tofts; HW, Heather Williamson.

In closing, can I ask East Norfolk recorders to please send their notes in a little earlier? This year, all but one set of notes arrived within the space of three days, during the second week of January 1990. This only allowed me two weeks to sort them out and put them in some semblance of order, as my very latest deadline to get the notes in Transactions is the last week of the month. This year, please can I have them before Christmas? Thank you in advance.

P.S. I have just heard that specimens of ALL species of *Amaranthus* are required by the BSBI referee for the genus, before they will be accepted, so please send one specimen of each species to either of us please, and we will pass them on. ALB

Reference

CLAPHAM. A.R., TUTIN, T.G. & WARBURG, E.F. 1985 *Excursion Flora of the British Isles* Cambridge: Cambridge University Press.

TROCHETA BYKOWSKII—A LEECH NEW TO EAST ANGLIA

A.G. Irwin

Castle Museum, Norwich NR1 3JU

On 8 May 1989, I collected two specimens of *Trocheta bykowskii* Gedroyć from a damp ditch in Surlingham Wood at Wheatfen Broad, E. Norfolk (TG325055). Although widely distributed in the British Isles (Elliott & Tullett, 1982), this species has not been recorded in East Anglia before. Like the more common horse leech *Haemopis sanguisuga* (Linn.), *T. bykowskii* spends much time out of water searching for its food which consists largely of slugs and earthworms. Unlike *Haemopis*, *Trocheta* species lay their egg cocoons in water, firmly attached to a rock or other substrate. The specimens I collected lived together in a box for a few days until one escaped and died. The other survived until August 1989 by which time it had produced several young. Unfortunately soon after the young were discovered, they and the adult died. All the specimens are now in the Norwich Castle Museum collections (acc.no. 177.990).

Elliot and Mann (1979) can be used for the identification of British leeches. The number and position of the eyes, the position of the genital pores and type of annulation are used to identify species of *Trocheta*, but *T.bykowskii* is distinctive in having small papillae over the dorsal surface, giving it a roughened appearance. When alive, it has a less flacid feel than *Haemopis*, as well as being smaller and paler.

Acknowledgements

I thank Paula Tullett for up-to-date information on the distribution of *Trocheta bykowskii* and Phyllis Ellis for permission to collect in Surlingham Wood.

References

ELLIOTT, J.M. & TULLETT, P.A. 1982 Provisional atlas of the freshwater leeches of the British Isles. *Occ. Publs Freshwat. biol. Ass.* **14**, 31pp.

ELLIOTT, J.M. & MANN, K.H. 1979 A key to the British freshwater leeches. *Scient. Publs Freshwat. biol. Ass.* **40**, 72pp.

TABANUS MIKI (DIPTERA: TABANIDAE) — A RARE HORSEFLY IN NORFOLK

K.C. Durrant

18 The Avenue, Sheringham, NR26 8DG

Whilst checking my collection of these fairly large conspicuous diptera using a recently revised key, I had a solitary male which proved difficult to place.

I determined my specimen as *Tabanus glaucopis* Mg. and forwarded my revised records. I was not surprised to receive a request to recheck as *T. glaucopis* is itself a scarce insect. Still not satisfied I asked Dr Tony Irwin for his opinion.

Using the most up-to-date continental keys we were still not certain and the specimen was dispatched to Alan Stubbs at Peterborough, who had his doubts so he forwarded it to John Chainey at the British Museum.

Imagine my delight when I received a communication that it was determined to be *Tabanus miki* Brauer, the first male to have been taken in this country. It is exceedingly rare, being first recorded in Britain from the New Forest in 1931 and then only as females. Further females were taken in Dorset and Warwickshire later.

My specimen was taken on a field trip of the Society held at Gooderstone Fen, W. Norfolk (TF751004) on 14th July 1968.

Fig. 1. *Tabanus miki* Brauer male. Gooderstone Fen. Scale line = 10 mm.

THE DRAGONFLIES OF NORFOLK

P. J. Milford
28 Lloyd Avenue, Taverham, Norfolk
A. G. Irwin,
Castle Museum, Norwich

Abstract

The results of a three-year survey of Norfolk dragonflies are compiled with older records to present an account of the distribution and status of the twenty-nine species that have occurred in the county this century. Tetrad distribution maps are produced for all the species.

Introduction

Dragonflies and damselflies (Odonata) are insects which have recently changed status in two quite different ways. Because their larvae have need of well-vegetated clean fresh water, the large-scale disappearance of such habitats from the countryside has produced a corresponding disappearance of many species from their former haunts. On the other hand, as they have become less common, so they have become more popular as objects of study, perhaps ranking with butterflies in terms of the number and enthusiasm of the amateur naturalists who observe and record them.

A National Recording Scheme for Odonata was launched in 1968, but it was not until the publication of the first well-illustrated guide to identification (Hammond, 1977) that the group became more popular, initially with entomologists, and then with bird-watchers. These latter naturalists brought with them their skills of field-identification, as well as their practice of 'twitching'. These have led to much-improved knowledge of the distribution and habits of both common and rare species. In Norfolk a major survey of Broadland dragonflies took place in the summer of 1975 (Ismay & Wright, 1975). This survey set out to examine former haunts of rare species to see if they still occurred there. The survey team was particularly concerned to find two species—*Aeshna isosceles* and *Coenagrion armatum* - which were unknown in Britain outside Norfolk. The survey found that *A. isosceles* still occurred at a number of sites in Broadland, but that *C. armatum* was probably extinct in this country. Another species, *Lestes dryas*, had also apparently disappeared from its former sites both in Norfolk and elsewhere, and it too was feared extinct, though 15 years later is known to be widespread but localised in East Anglia.

Earlier studies of dragonflies in Norfolk

Norfolk and the adjoining Fens had long been considered an important area for dragonflies—"...next to the New Forest, probably the best hunting-ground for dragonflies in the British Isles" (Bath, 1892). Among the less likely sites mentioned in the early works are Sprowston for *Libellula fulva* and Costessey for *Cordulia aenea* (Bath, 1890). Later accounts of the county's dragonflies can be gleaned from Lucas (1900a), Longfield (1949) and Corbet *et al.* (1960). These describe *L. fulva* as widespread and sometimes abundant on the Broads, while *O. cancellatum* was rare and local—a situation that has reversed in recent years. Many of these accounts were based on work done at the Sutton Broad Laboratory and published by Balfour-Browne (1904). During the following 50 years both E.T. Daniels and A.E. Ellis made a large

number of field observations, on which was based the account of dragonflies in The Broads (Ellis, 1965). Durrant (1960) published a short paper on rare species in other parts of Norfolk.

The Norfolk Dragonfly Survey 1987—1989

With the proposed publication of an atlas of British dragonflies (originally planned for 1988, now destined for 1990) it was felt that the increasing numbers of potential recorders should be encouraged to survey the county's dragonfly fauna more thoroughly. Thus the present Survey was launched in 1987, in order to map the distribution of Norfolk dragonflies on a tetrad (2km square) basis. It was originally hoped to survey every tetrad in the county, but this has not proved possible. Dragonflies prefer not to fly in dull, wet or windy weather, and two seasons provided poor recording conditions. Some privately-owned sites have been difficult to access and this, combined with the dragonflies' natural 'reticence', means that many tetrads have been at best poorly-recorded. Large areas of unproductive country, notably in north-west Norfolk and the Fens, were surveyed with many negative reports. By the end of the 1989 summer, it was decided that to continue recording in order achieve 100% coverage would not repay the effort involved.

Of the 1437 tetrads wholly or partly in Norfolk, 834 were surveyed. Negative records were returned for 109 tetrads most of which appeared to have no suitable habitat. These have been marked on the 'all records' map (Fig. 1).

As a result of the survey, *Lestes dryas* and *Libellula fulva* have been shown to be much more widespread than thought in recent years. On a less optimistic note, *Orthetrum coerulescens*, *Cordulia aenea* and *Ceriagrion tenellum* are still recorded only from single sites, and *Calopteryx virgo* is no longer found in the county. Despite intensive searching of several Broadland sites, *Coenagrion armatum* was not rediscovered and must be presumed extinct.

Copies of the data from which the maps were prepared can be consulted at the Norfolk Biological Records Centre at Norwich Castle Museum.

Future recording

The emphasis of dragonfly recording will now be to establish which sites are important for breeding, and to monitor the populations of rare species in the county. This work should provide the information necessary to make the right management decisions to protect all the Norfolk species including those for which the county is a stronghold.

Notes on the maps

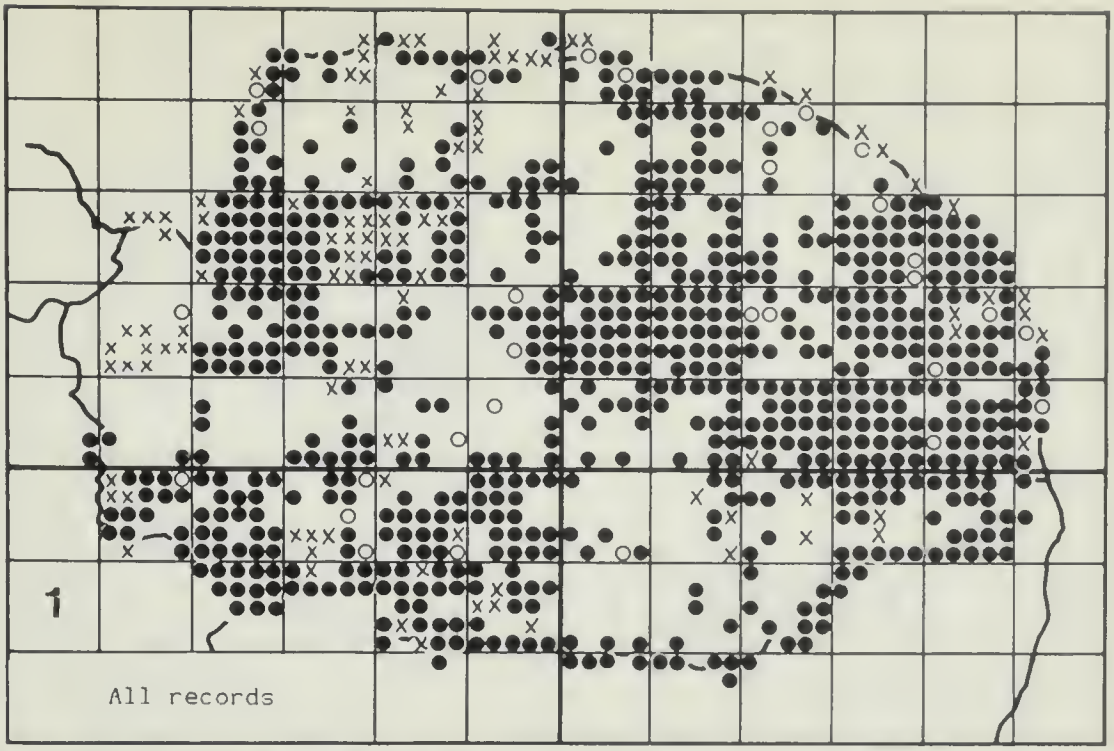
The 1980-1989 records are plotted as solid symbols and pre-1980 records as open symbols. Crosses on Fig.1 mark tetrads with apparently no suitable habitat, and for which negative records were returned.

Species Accounts

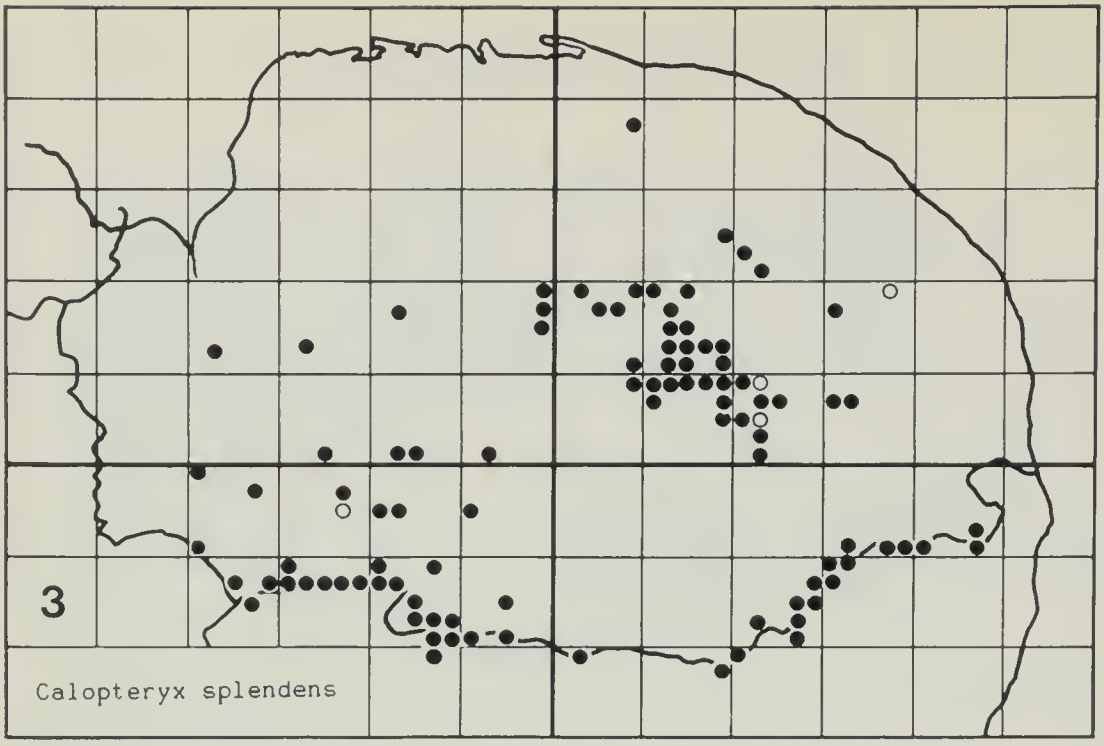
The order of species and nomenclature follow the check-list in Askew (1988).

Calopteryx virgo (Figs 2, 31)

The **beautiful demoiselle** is virtually unknown in the county due to the scarcity of its favoured habitat—clean, fast flowing rivers or streams, with stony bottoms



and trees sheltering the banks. The species can occur with *C. splendens* where the habitat is variable but should not be confused as the beautiful all blue-green wings (males) or evenly suffused brown wings (females) are diagnostic. In Norfolk it has not been recorded since 1975 when one was seen on the River Wissey, but it may be undiscovered in the few suitable localities that remain. Adults are early emergers, on the wing through the summer from mid-May to the end of August.



Calopteryx splendens (Fig. 3)

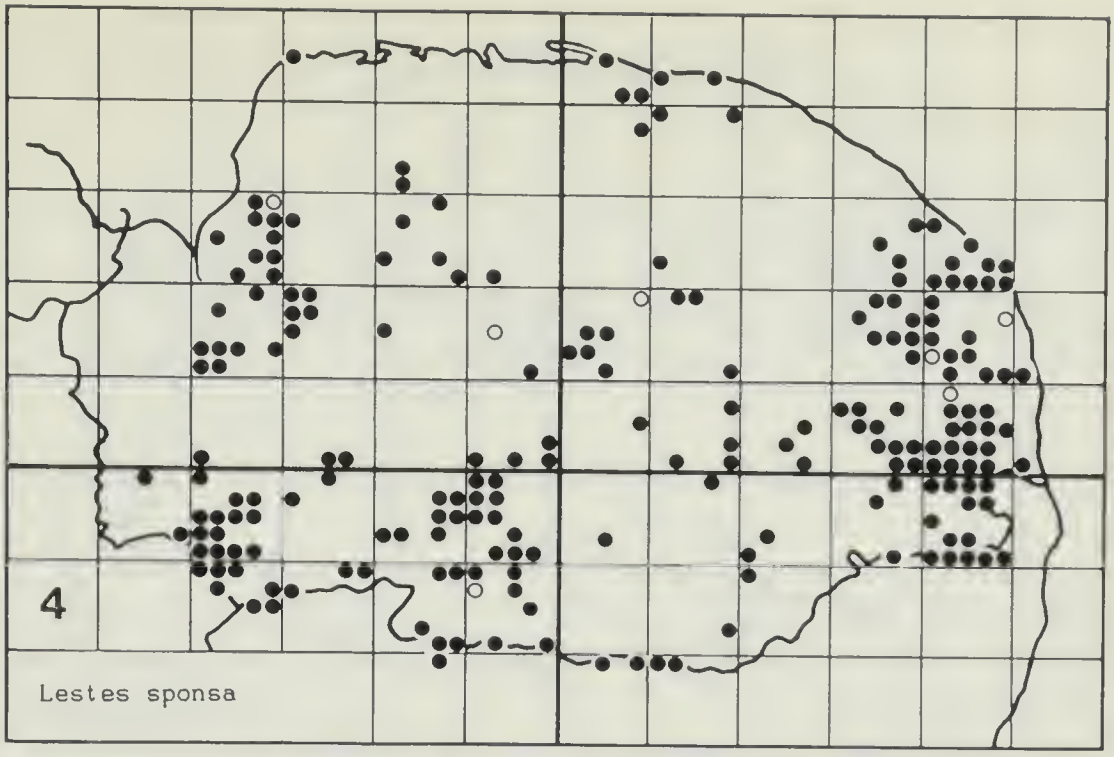
The **banded demoiselle** is local, though common where found, on some of the larger Norfolk rivers with well vegetated banks. It flies from early June to late August, slightly later emerging, but otherwise over the same period as *C. virgo*. The females may be confused but *C. splendens* has translucent metallic green wings. Rivers with muddy bottoms are required for the larvae and emergent or floating vegetation for males to display on. *C. splendens* is one of the few British species to have a distinctive courtship display where the male reacts to a visiting female by spreading his irridescent wings and raising the abdomen. He flies back and forth always orientating his face towards her so as to display his metallic colours to their best advantage.

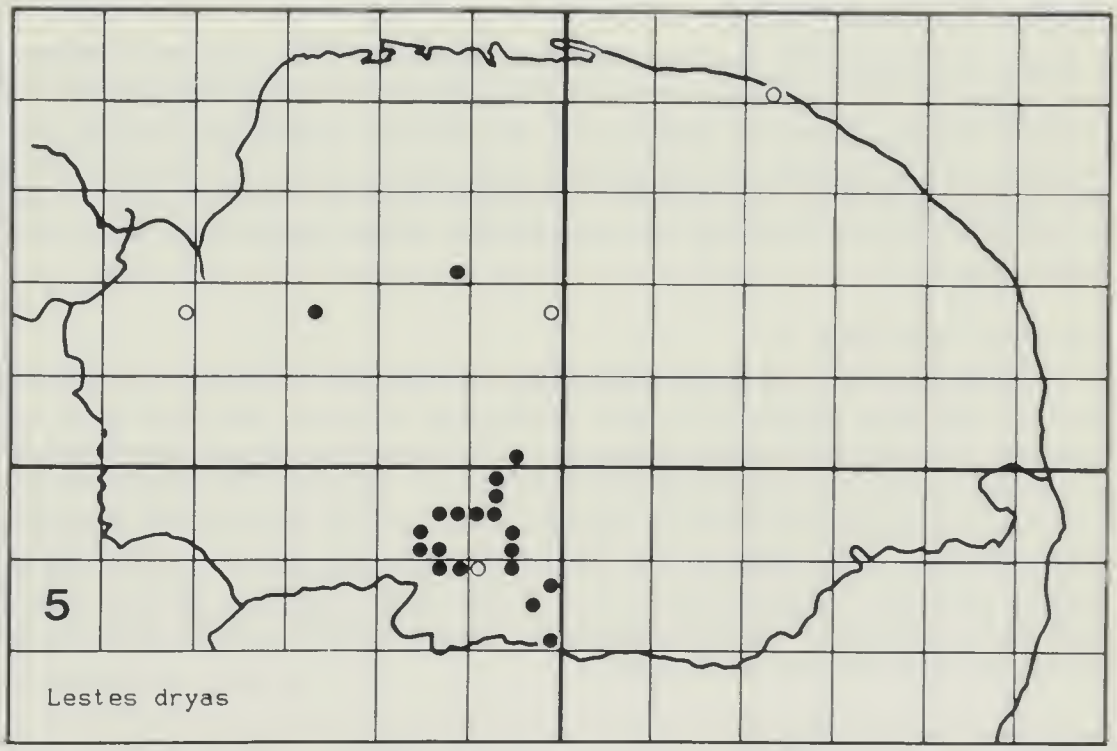
Lestes sponsa (Fig. 4)

The **emerald damselfly** is common and widespread in the county where there is dense emergent vegetation, especially *Juncus*. It is a rather passive species without notable characteristics. Both this and the next species remain close to vegetation, settling frequently and rarely going far over water. It is on the wing from late June almost to the end of September in good summers. Both sexes can be confused with *L. dryas* with which it flies where colonies share the same habitat. For males check the inner anal appendages which are straight and tipped yellow. In the female look for segment one where the two markings are rounded and edged in gold. Both sexes are more slender than *L. dryas*.

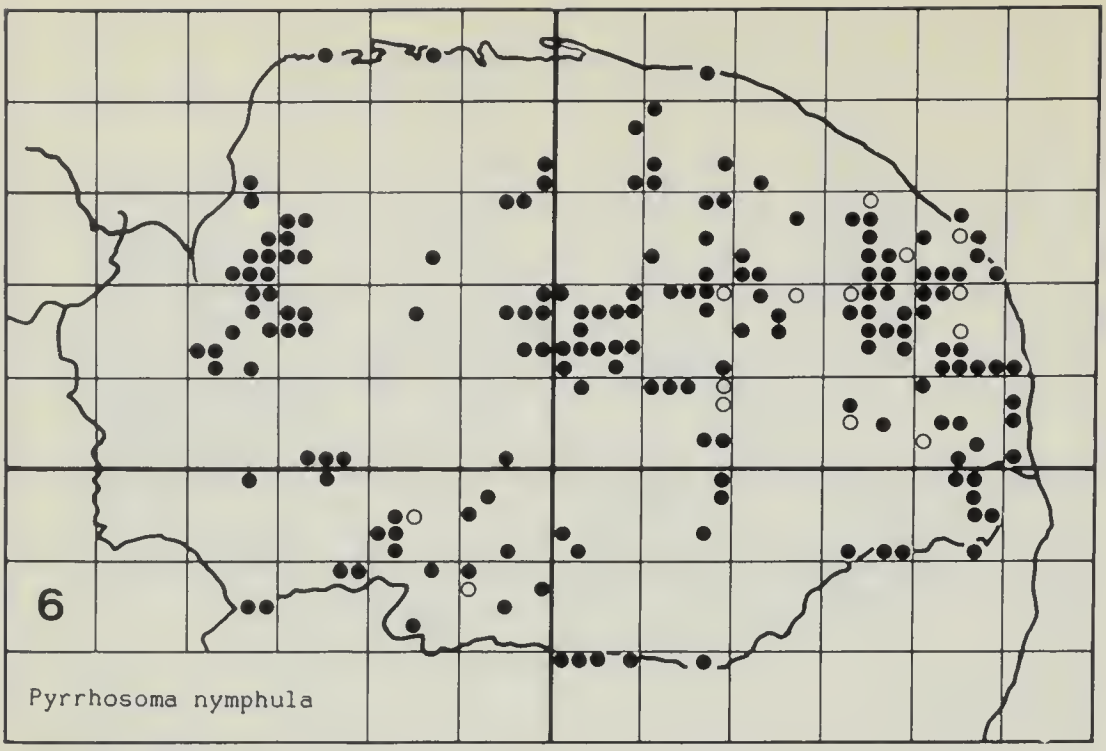
Lestes dryas (Figs 5, 32)

The **scarce emerald damselfly** was formerly thought to be extinct in Britain due to habitat loss and pollution. However as a result of the Survey, we know of many sites in Norfolk where this nationally rare species can be seen. It is still only known in the west of the county but may have been overlooked or misidentified elsewhere.





In males, there is a reduced amount of blue on segment two and the inner anal appendages are red at the base, and curve inwards towards the centre. Females have two square markings on segment two. Both sexes are much more robust than *L. sponsa*. They emerge a week or two earlier but only fly until about the third week of August.



Pyrrhosoma nymphula (Fig. 6)

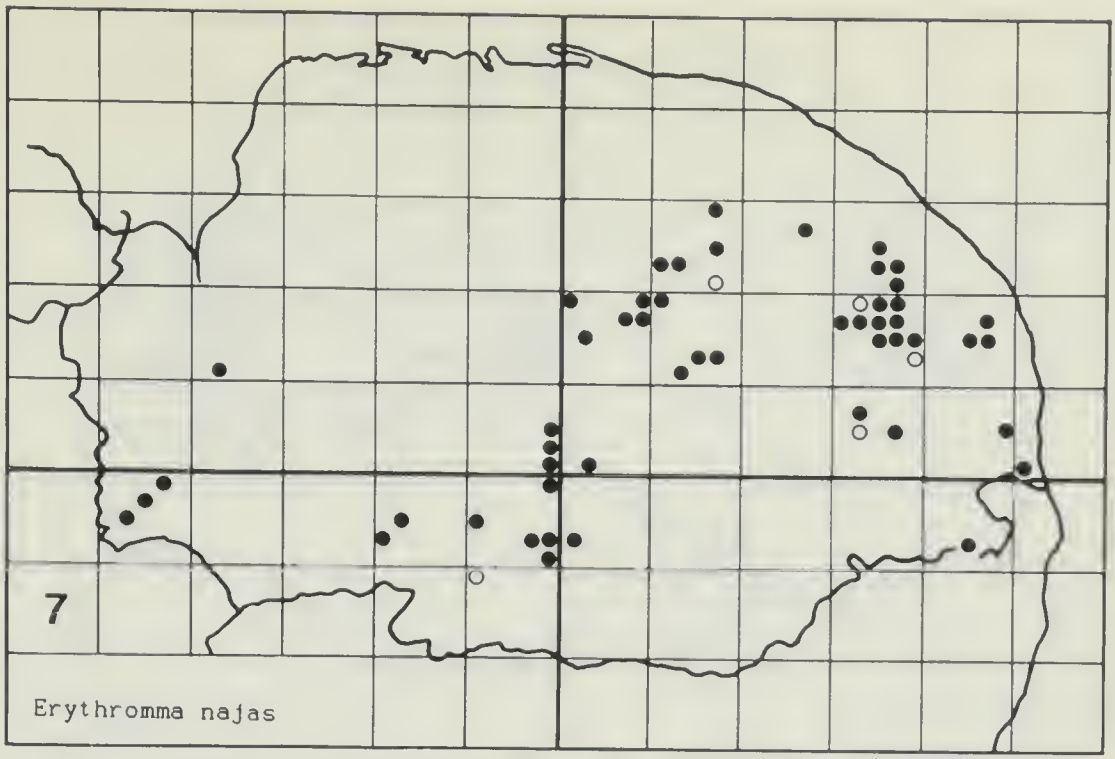
The **large red damselfly** is always the first damselfly to be seen each spring. It usually appears at the end of April or early May and lasts through the summer until the end of August. It can be found in all wet habitats except fast flowing rivers and streams, and is common and widespread in our region. It is a slow moving species, readily approached. Only the delicate *C. tenellum* could be confused with *P. nymphula*, but the latter has black legs and red shoulder stripes, and is much more robust in both sexes.

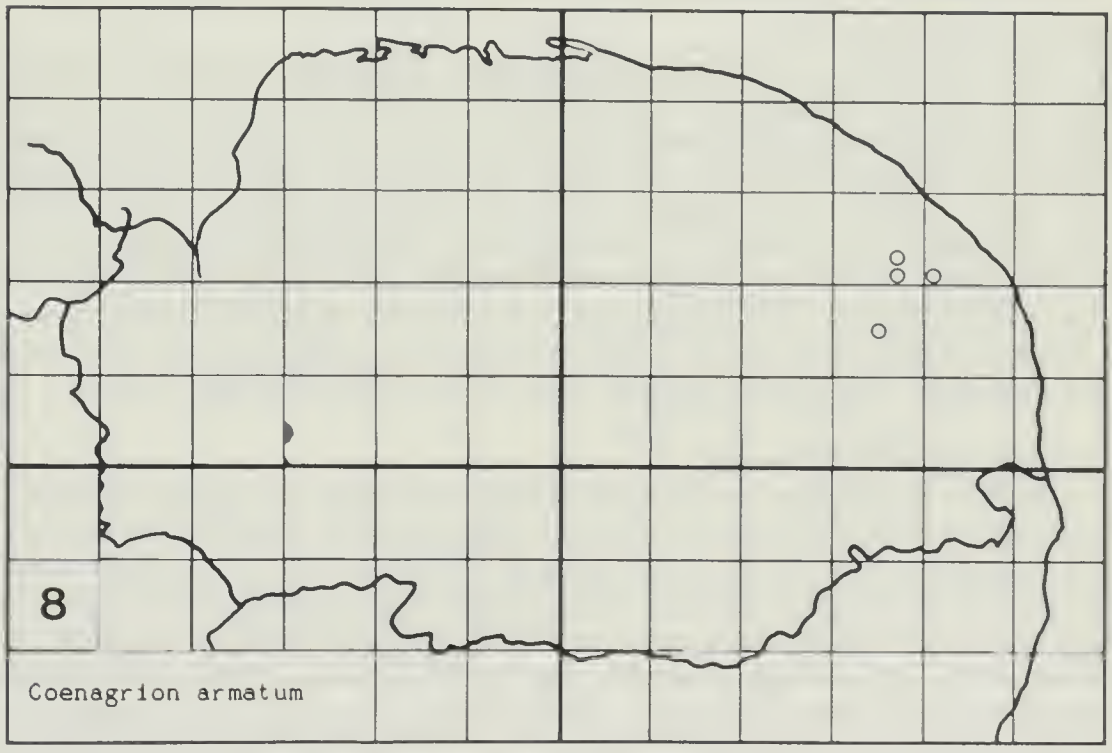
Erythromma najas (Fig. 7)

Prior to the Survey the **red-eyed damselfly** was thought to be scarce in Norfolk. However it has been found to be quite widespread in gravel pits, and pools with floating lily pads or other surface vegetation. It is larger than the average damselfly, but at a distance bears a superficial resemblance to *I. elegans*. The bright red eyes, lack of thoracic stripes, and blue on segments nine and ten of males are diagnostic. The females have green sides to the thorax and very fine partial thoracic stripes, but similar coloured *I. elegans* females have a blue eighth segment, whereas *E. najas* females have uniformly coloured abdomens. *E. najas* adults appear early to mid-May and fly until the end of August.

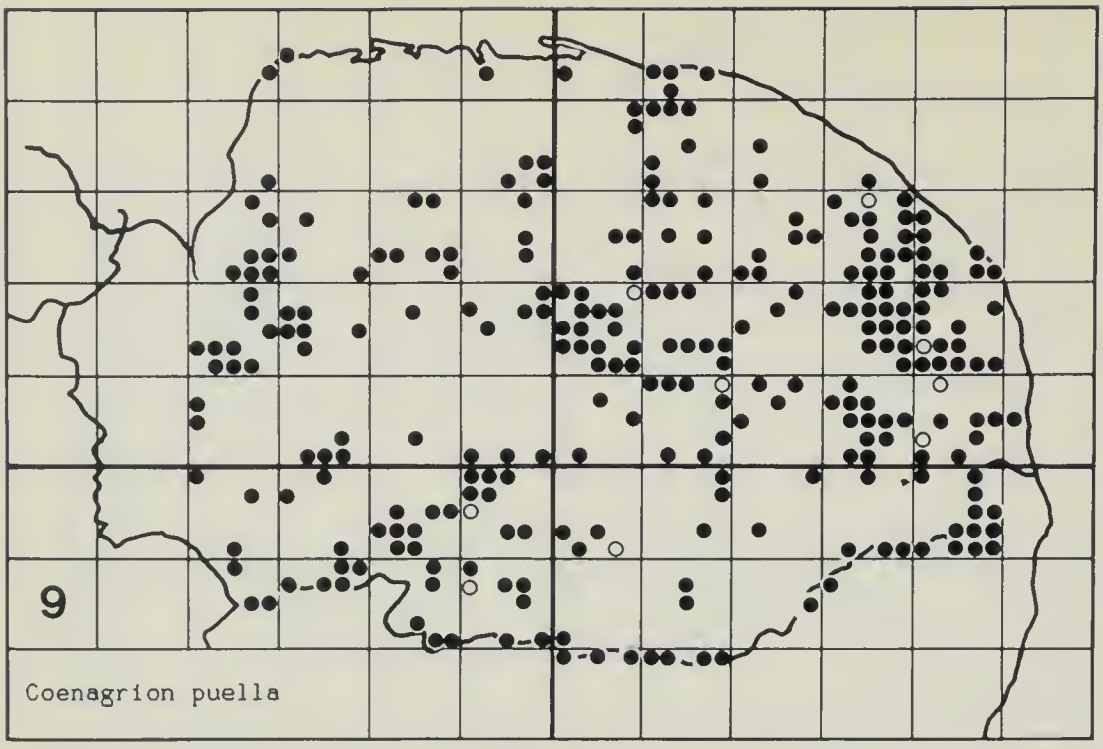
Coenagrion armatum (Fig. 8)

Regrettably the **Norfolk damselfly** has yet to be rediscovered, despite periodic searches in areas within striking distance of its last known site, Big Bog near Sutton Broad. That site, and other suitable habitat nearby, was found to be polluted, so if still extant, it will be found in an area perhaps cut off from such sources of pollution. This slow-flying *Coenagrion* is unlikely to recolonise from the continent being known no nearer than Germany or Denmark. The last record we have was in 1968.





C. armatum has only a short flight period from late May to the end of July. It is a dark looking insect, with no thoracic stripes in the male, and blue on segments two, eight and nine of the abdomen. The rest of the abdomen is black with a black blob on segment two and long anal appendages. The female has pale green thoracic stripes with green on segment two and part of segment eight of the abdomen which is otherwise all dark.



Coenagrion puella (Fig. 9)

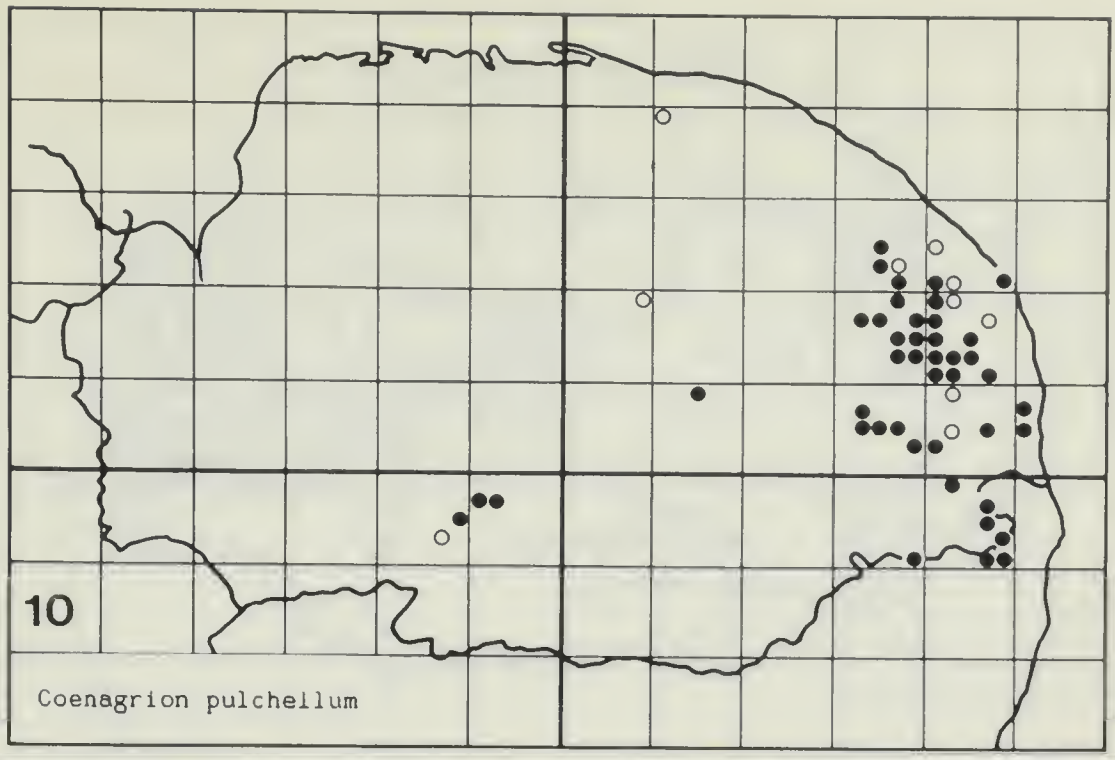
The **azure damselfly** is one of the most common damselflies not only in Norfolk but also in the rest of England and Wales. Almost any still, or slow moving, body of water should hold *C.puella* if unpolluted. Individuals will wander away from water especially into lush meadowland or other relatively dry habitats. It is superficially similar to *C. pulchellum*, but look for continuous thoracic stripes, U-shaped mark on segment two, not connected to black segment joint, and black marks into the blue of segment nine (males). Females come in two forms. The normal form has all dark abdomen with yellow segment joints, but blue joints on eight, nine and ten. There is a blue form similar to *C. pulchellum* but with only four blue marks on the abdomen. The adults fly from early to mid-May until late August.

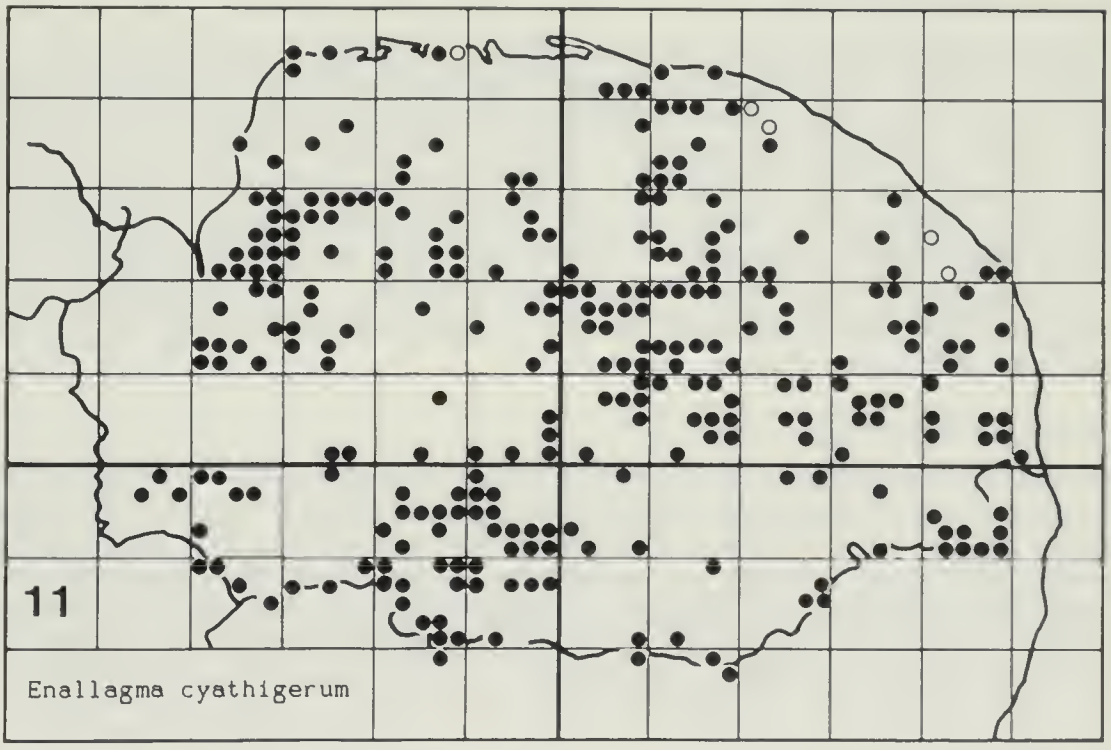
Coenagrion pulchellum (Fig. 10)

The **variable damselfly** is nationally scarce in Britain, but fairly common in Broadland, sometimes being more abundant than *C. puella*. Elsewhere in the county it is only found in a few scattered sites. In Broadland the species flies with *C. puella* and care is needed to identify them. Males of *C. pulchellum* have (normally) broken thoracic stripes, a black wine glass mark on second segment and clean blue ninth segment. Females have a mercury mark on the second segment slightly different to the thistle shaped mark on *C. puella* females. They also have five abdominal blue marks in the normal form. Overall, *C. pulchellum* favours marshy dykes in meadows rather than ponds and pools. It flies from mid-May until mid-August.

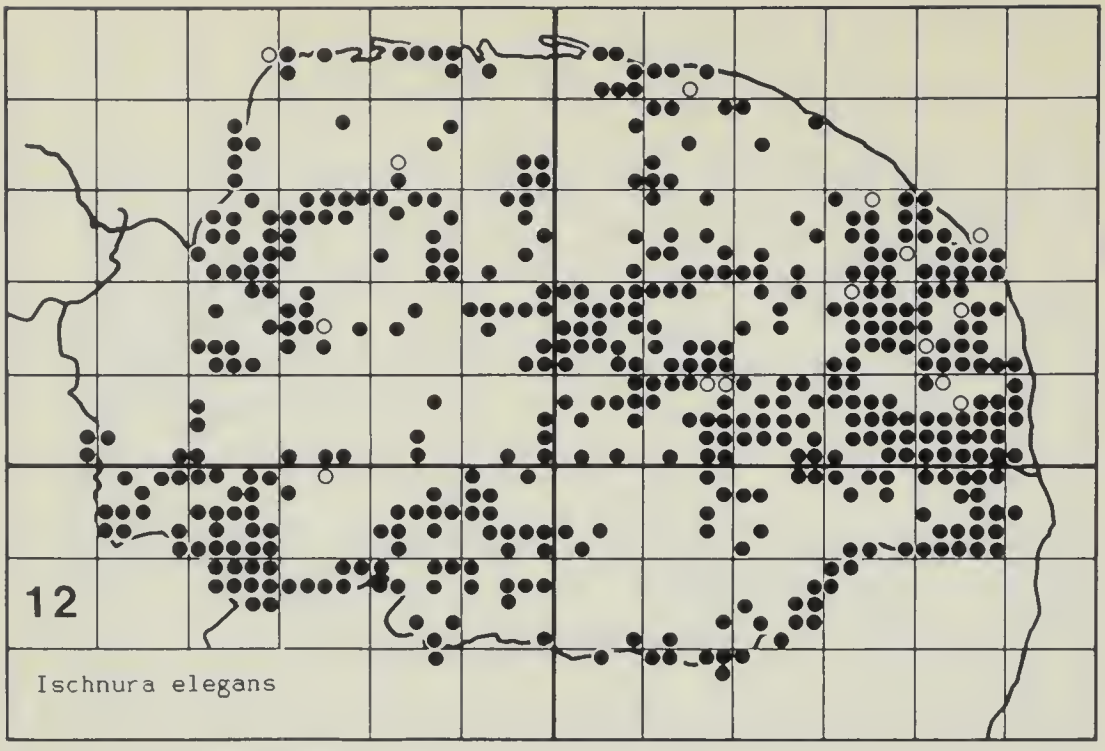
Enallagma cyathigerum (Fig. 11)

The **common blue damselfly** is abundant and widespread in the county. It can be confused with several of the *Coenagrion* species but tends to be a paler shade of blue. All the blue damselflies have different markings on the second segment,





particularly males. *E. cyathigerum* has a black blob with a stalk attached to a black line. Shoulder stripes are much wider than *Coenagrion* species. This also applies to females which come in a blue form and a dull greenish/buff form. These are separated from *Coenagrion* by a thin black line on the sides of the thorax. The adult flies from mid-May until the end of September in good summers.



Ischnura elegans (Fig. 12)

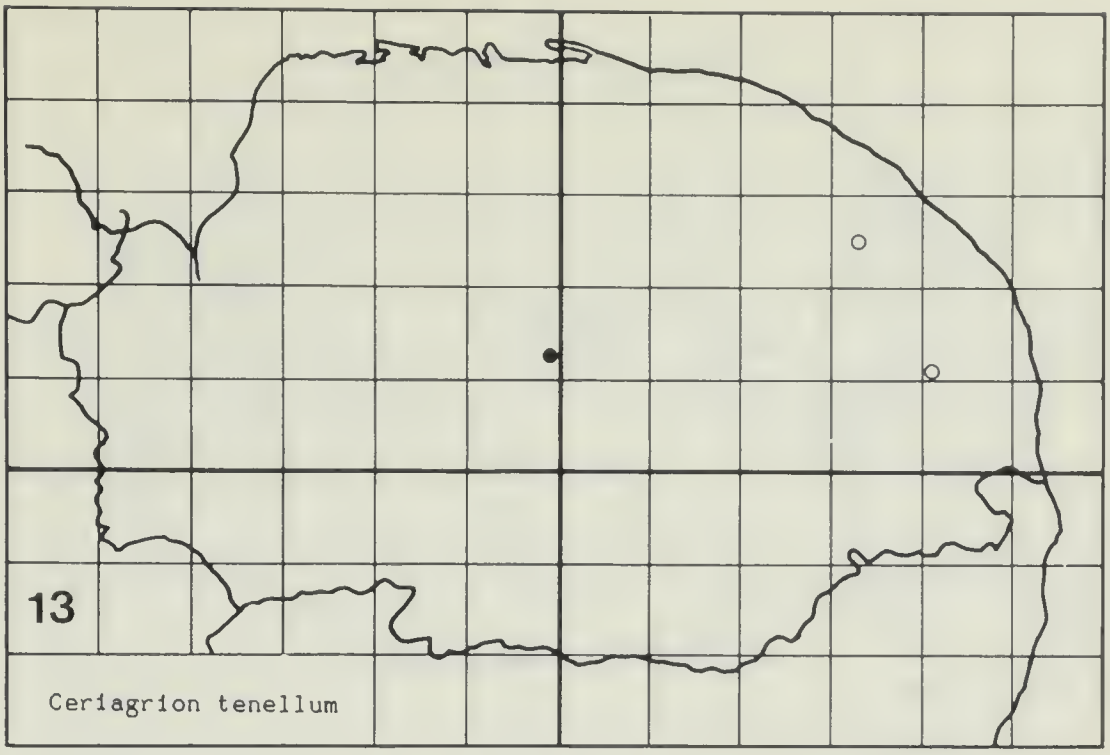
The **blue-tailed damselfly** is the commonest and most frequently encountered damselfly. Able to withstand some degree of pollution, it is frequently the only species found in unsavoury areas. Males are distinctive, largely black with thin blue stripes on the thorax, and blue segment eight. Females come in six colour forms: normal form, similar to the male, green sides to thorax, blue segment eight; *violacea* has violet thorax, otherwise similar; *infuscans* has olive green thorax, brown segment eight; *infuscans-obsoleta*, light brown thorax and segment eight, and *rufescens* with rose pink thorax and blue segment eight. Only *E. najas* in our area could be confused with *I. elegans* (see description above). *I. elegans* flies from mid-May to early September, sometimes later.

Ceriagrion tenellum (Fig. 13)

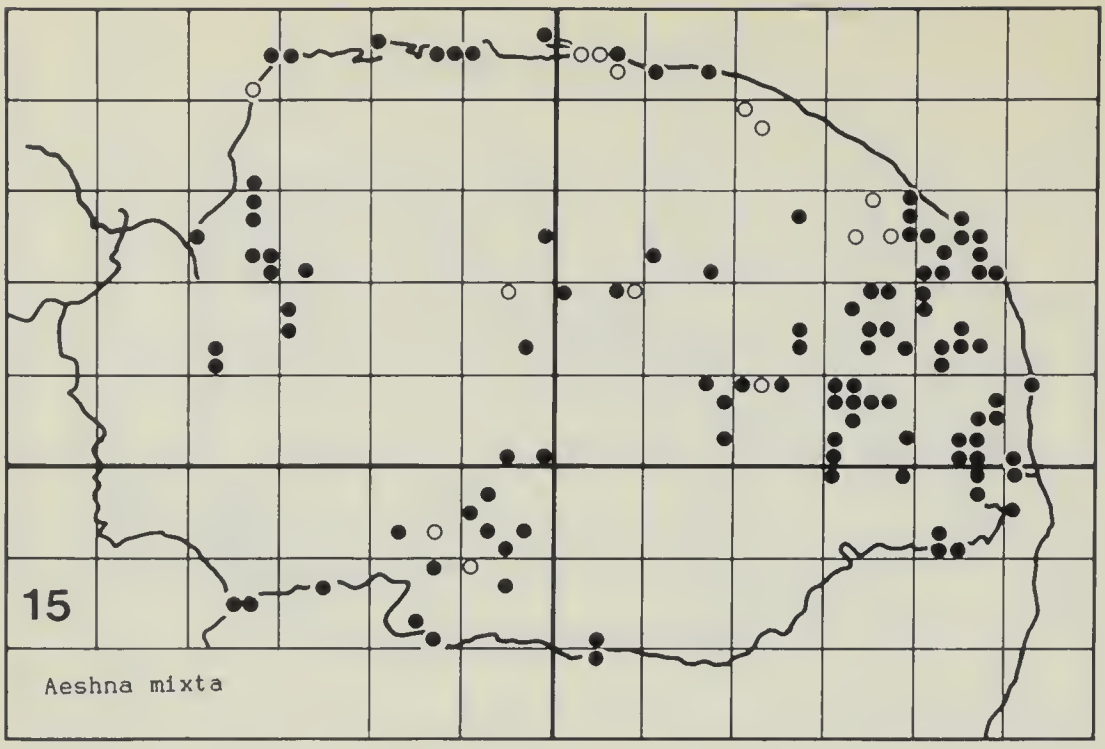
The **small red damselfly** is only known from Scarning Fen in Norfolk, and even this nature reserve is threatened by pollution from the adjacent by-pass. This fragile insect is an acid water species in Britain and does not colonise new sites easily. It is a weak flier, rarely moving far, and settling readily. *C. tenellum* flies from early to mid-June until the end of August. Its habitat is shared with the larger *P. nymphula* but the legs are red in both sexes. The males have an all red abdomen and in the females segments 4-8 are all black.

Aeshna juncea (Fig. 14)

The **common hawker** is a misnomer indeed for it is one of our rarest dragonflies. Although previously known from only one site, it has been discovered at a few other places, mainly in the east of the county. It remains extremely scarce however. Preferred habitat in Norfolk seems to be open heath or pasture with pools or dykes. Males are very territorial and aggressive. The dragonfly flies from mid-July to the end



of September. With reasonable views the golden leading edge to the wings, all blue spotted abdomen (male) or yellow spotted on brown abdomen (female) will separate *A. juncea* from the similar *A. cyanea* and *A. mixta*.



Aeshna mixta (Fig. 15)

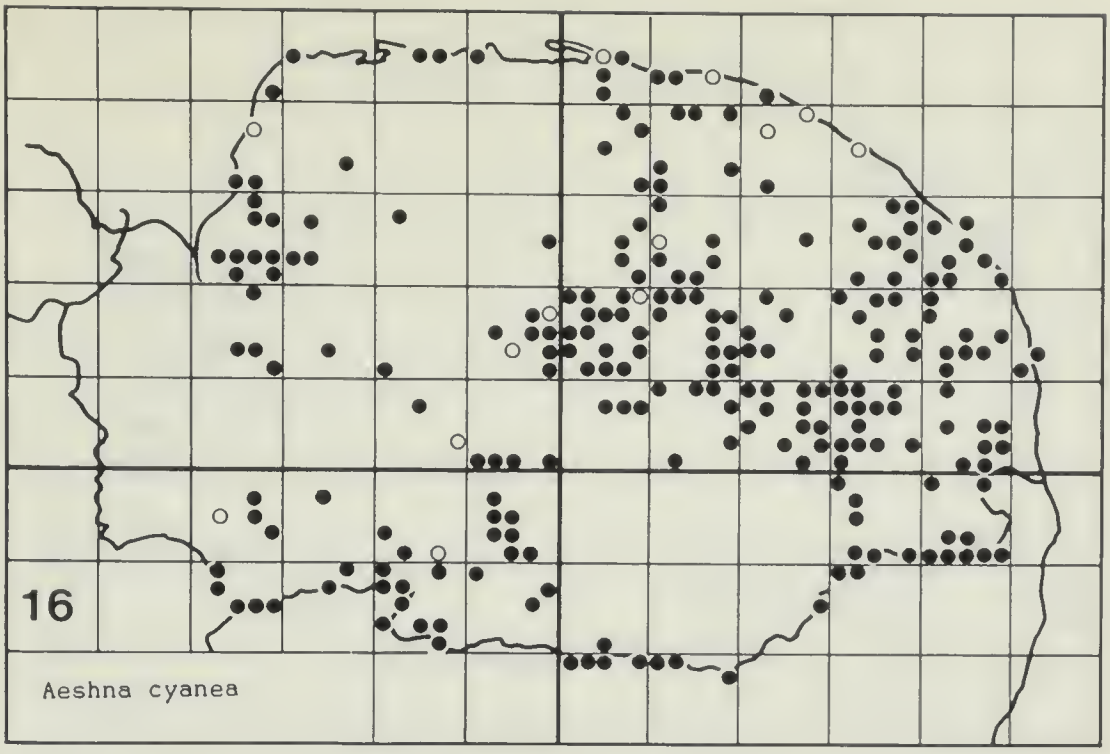
The **migrant hawker** is fairly common in the county. Resident populations are reinforced by migrants from the continent. Although it may be found in a variety of habitats, it seems to favour open woodland rides and clearings. Several males can gather, showing no territorial behaviour, they fly high, and hover frequently. This may help to identify it at a distance from the similar *A. cyanea* and *A. juncea* from which it may be separated by smaller size and generally darker appearance. The insect is on the wing from early August until as late as mid-November, providing there are no frosts.

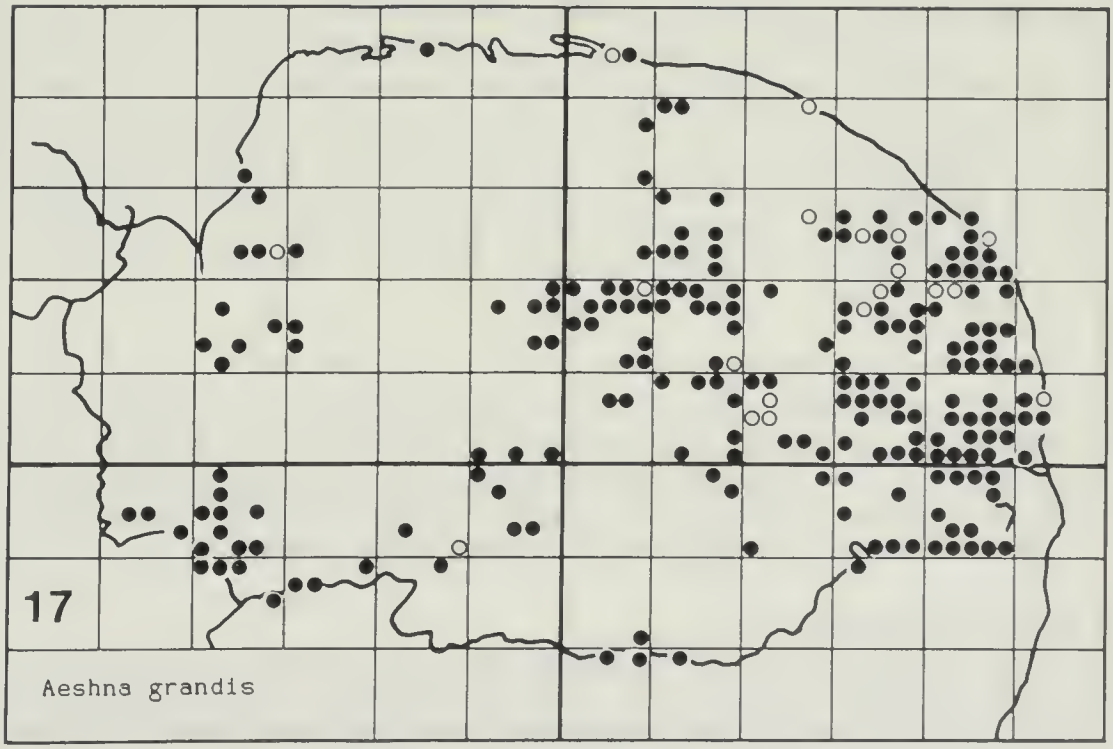
Aeshna cyanea (Fig. 16)

The **southern hawker** is common and widespread in Norfolk, often breeding in garden ponds, but it can be found in a wide variety of habitats, and is another species not restricted to water, sometimes wandering far and wide and often hawking in woodland rides even after dusk. It flies from late June until early October. It can be confused with the fairly similar *A. mixta* and *A. juncea*, but is much larger than the former and generally greener and differs from both these species in its apple-green sides to the thorax in both males and females.

Aeshna grandis (Fig. 17)

The **brown hawker** is common and widespread in Norfolk from early July to late September. It flies high along the margins of well vegetated ponds, lakes and canals but wanders far from water on occasions, and several may be seen in sheltered clearings in woodland hawking for insects. It cannot be confused with any hawker other than the rare *A. isosceles* but can be easily identified with reasonable views by its all brown suffused wings and darker brown body.


16
Aeshna cyanea


17
Aeshna grandis

Aeshna isosceles (Fig. 18)

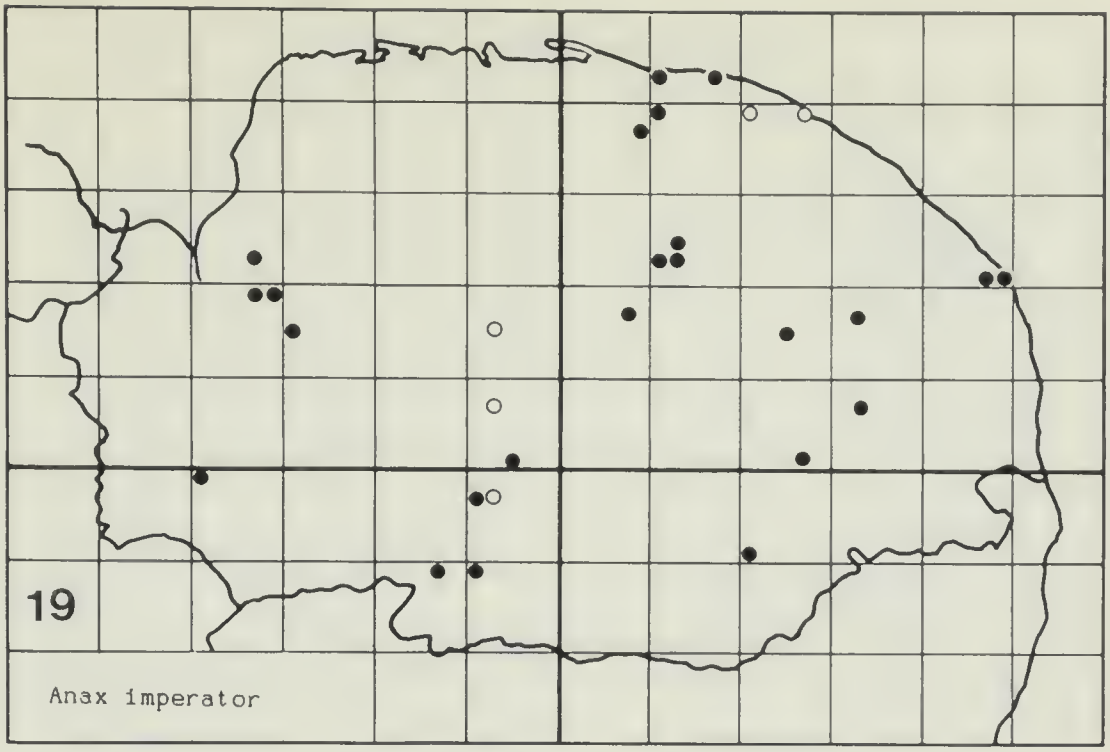
The **Norfolk hawker** is largley confined to the Broads, apart from isolated occurrences near the River Waveney in the east of the county. In its stronghold it can be found in reasonable numbers, and may be on the increase where waters are unpolluted. It favours clean dykes and does not move far from water. It is on the wing from the end of the first week of June to as late as early August in good summers. It flies high when over woodland dykes but should not be confused with *A. grandis*, for its green eyes, tan body, yellow triangle and clear wings are distinctive. Specific surveys of *A. isosceles* were carried out in 1983 by Driscoll (1984) and 1983 and 1984 by Merritt (1985). Although the species appears to be secure at present, the general decline in dyke quality described by Doarks (1990) must give cause for concern.

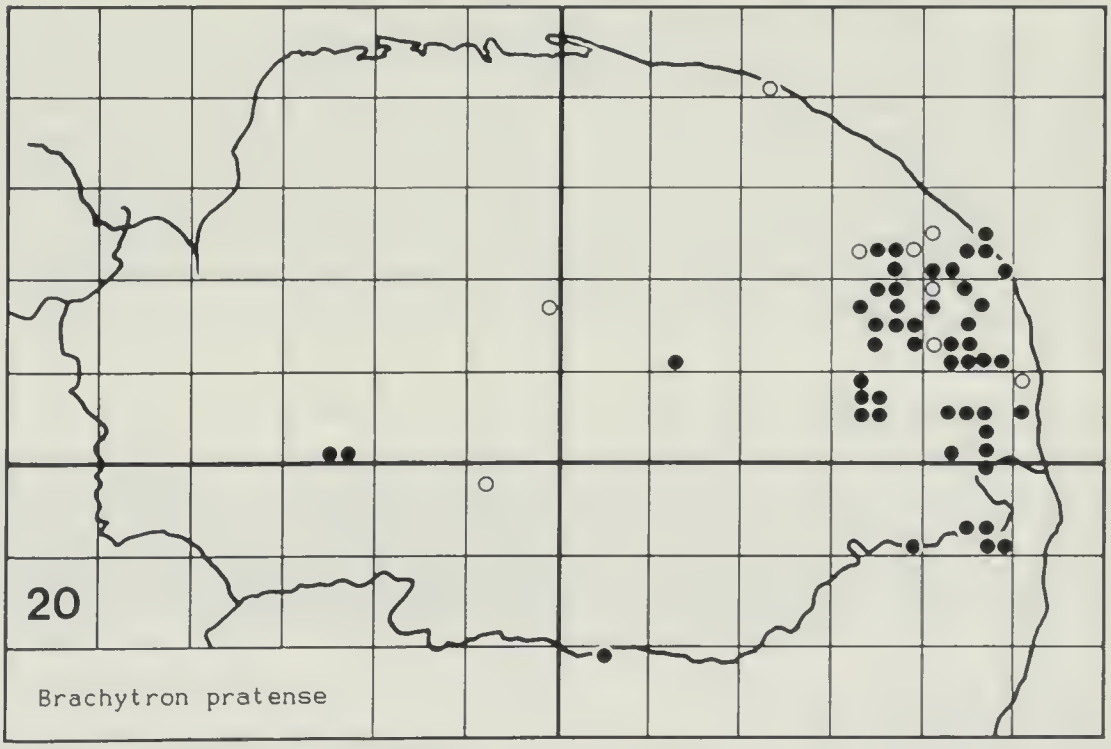
Anax imperator (Fig. 19)

The **emperor dragonfly** is the largest British dragonfly in most respects. It flies from early June to the end of August, favouring still sheltered waters, over which it flies searching for insects. The characteristic long, drooping abdomen (blue in the male, green-brown in the female) separates it from the similar *Aeshna* species. In Norfolk it is widespread but never common, being present at about 25 sites.

Brachytron pratense (Fig. 20)

The **hairy dragonfly** is one of the earliest species on the wing, flying from mid-May to the end of June or early July. Although generally scarce in the Britain, *B. pratense* is fairly plentiful in Broadland though very local elsewhere in Norfolk. It particularly favours dykes and carefully works its way along the vegetated margins closely following the contours, searching for insects. The male has a yellow frons,





blue eyes, brown thorax, and pairs of blue spots down the abdomen. The female has yellow frons, brown eyes, brown thorax without thoracic stripes and pairs of yellow spots down the abdomen. Both have apple-green sides to the thorax.

Cordulia aenea (Fig. 21)

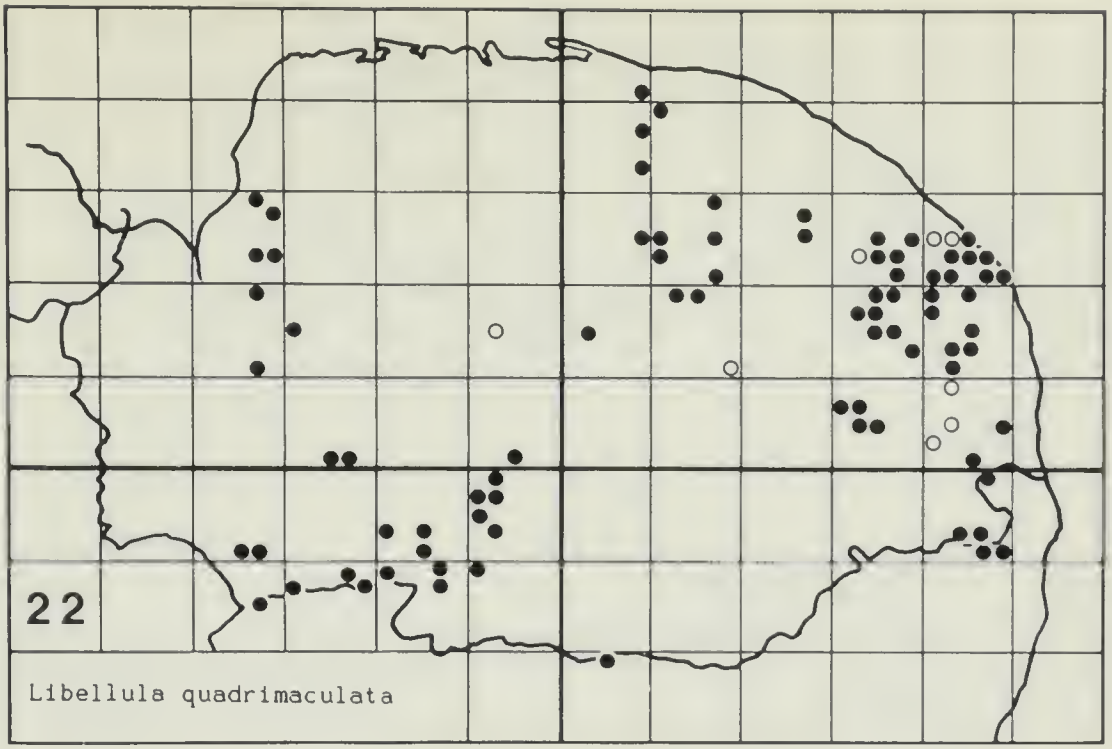
The **downy emerald** is the rarest and most recently rediscovered Norfolk dragonfly, known from only one site in north-east Norfolk well away from the previously recorded sites near Horning and Lynford. Nationally scarce except in a few south-eastern counties, it is on the wing from the end of May to mid-July. It is a fast flier keeping low over the water, patrolling a beat along the edge of pools or canals and frequently stopping to hover at a given spot. It should not be confused with any species, other than perhaps *Somatochlora metallica*, which is not found in our region. The male has green eyes, bronze-green downy thorax, and waisted bronze abdomen. The female is very similar, but much thicker in the abdomen. The recent records are here treated as confidential, the site being on private property, and are thus not mapped.

Libellula quadrimaculata (Fig. 22)

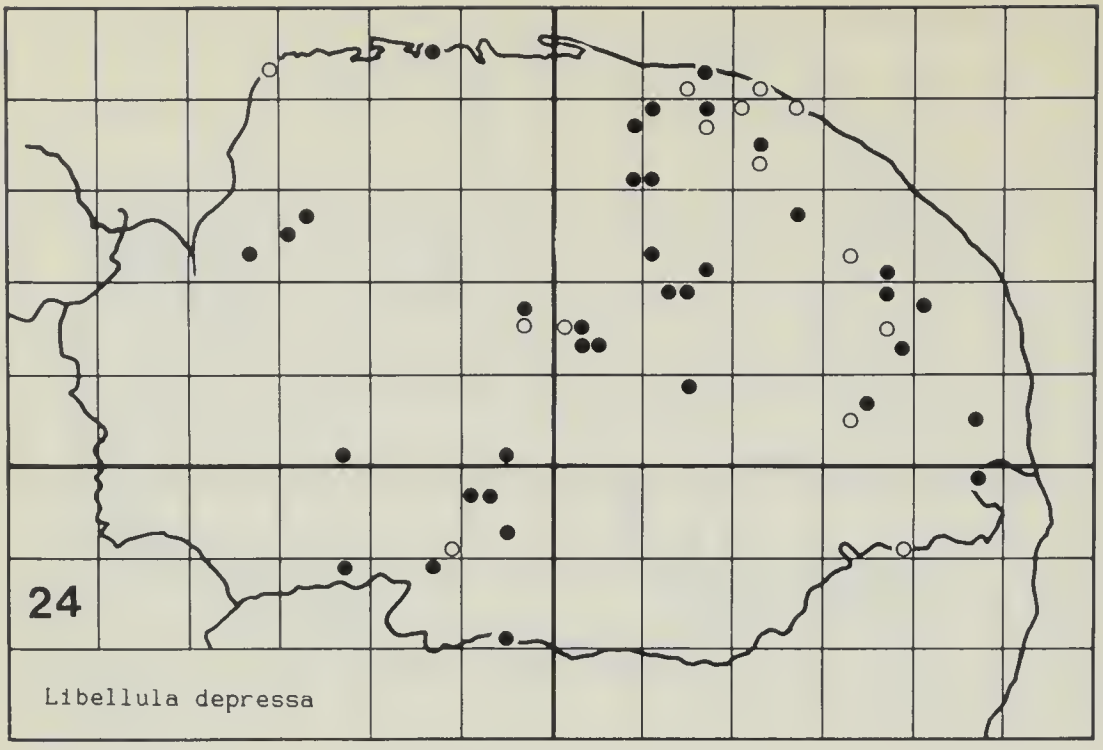
The **four-spottted chaser** is widespread in Norfolk but not as common as might be expected from its status in Britain generally. It prefers still, acidic waters particularly well-vegetated and shallow pools or dykes where males will defend a territory very actively and aggressively. The species is an early one, flying from late May to late August. The four black spots on the wings are diagnostic, the only species likely to be confused being female *L. depressa*.

Libellula fulva (Fig. 23)

The **scarce chaser** has been rediscovered in Norfolk in the Waveney and Yare valleys, well away from its early haunts along the River Ant from which it now seems to have disappeared. It is a nationally scarce dragonfly which has a liking for slow moving rivers with lots of cover along the banks. Its behaviour is much the same as other *Libellula*. Emergence is slightly later, being from early June to



early July. The species often confused with it is *O. cancellatum*, but the black triangle in the hindwings, next to the body, and reduced amount of black on last two abdomen segments will distinguish it. Only the males may be confused, as females and young males are a beautiful tan colour with joined black triangles on the centre of the abdomen. The females have dark wing tips.



Libellula depressa (Fig. 24)

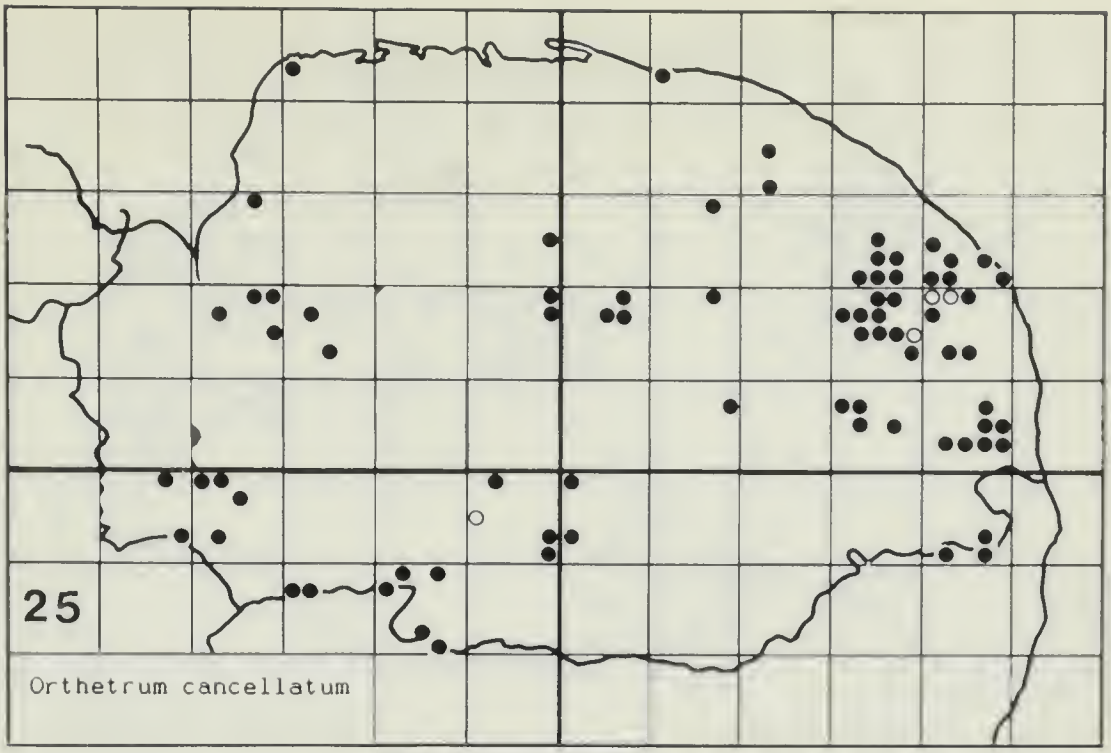
The **broad-bodied chaser** is another early species, being on the wing from mid May to early August. In Norfolk it is evenly spread about the county but nowhere is it common. The preferred habitat is sheltered pools or ponds with good marginal vegetation where males show aggressive territorial behaviour against allcomers, often using the same perch day after day. The species often wanders and migrates, and so can colonise newly formed habitats like gravel pits and garden ponds quite readily. The male's large flat blue body, and female's brown body, both having yellow spots on the sides, and distinctive brown triangles on both sets of wings next to the body make the species easy to recognise.

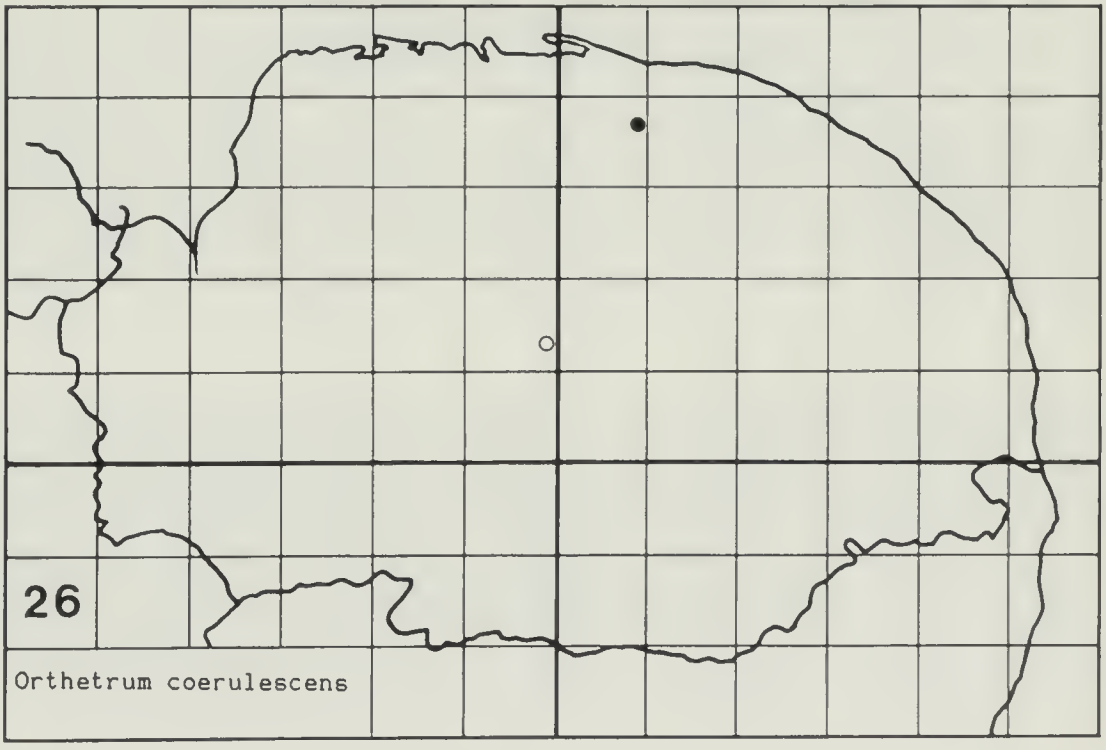
Orthetrum cancellatum (Fig. 25)

The **black-tailed skimmer** is common in Broadland, and widespread elsewhere in the county on gravel pits and shallow ponds and lakes. Males will defend a territory, frequently returning to the same spot on the bare ground to bask. They appear on the wing at the end of May until mid-August. Immature males and females are yellow-brown with curved black lateral lines on each segment. Males are blue on the abdomen but at least the last three segments are black. The wings are entirely clear in both sexes.

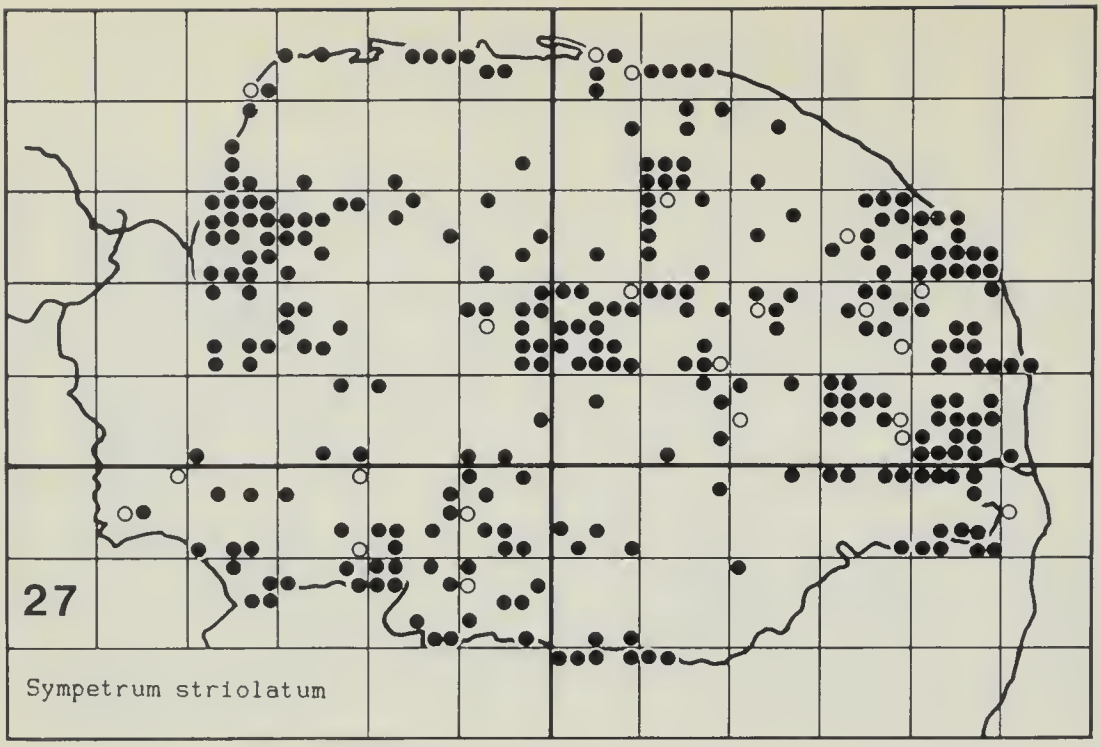
Orthetrum coerulescens (Fig. 26)

The **keeled skimmer** is only known from a single site in North Norfolk, perhaps due to the scarcity of its preferred habitat of acid bog, marshes and moorland with running water and *Sphagnum* pools. It is smaller than the commoner *O. cancellatum*, with totally blue abdomen in the male. Immature males and females are golden brown with a dark central line along the abdomen. The wings are tinted saffron, mainly





along the leading edge, but all over in some individuals. It flies from the second week of June to the end of August, and rarely travels far from its larval habitat.



Sympetrum striolatum (Fig. 27)

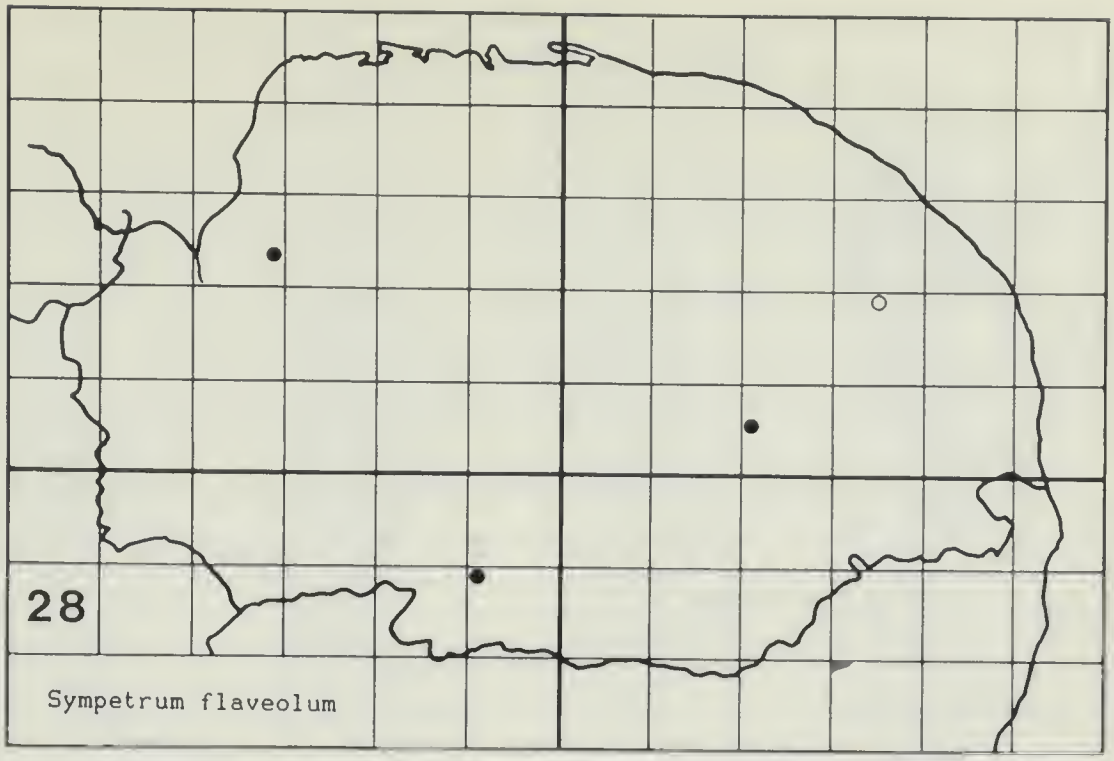
The **common darter** is widespread and common in the county, particularly in woodland and heathland habitats, but it can be found almost anywhere. Males are more aggressive than other *Sympetrum*, often attacking other males or even larger dragonflies. They settle frequently, and, later in the day, and more generally later in the season, will choose warm, flat, often light-coloured surfaces on which to rest. In Norfolk the main species causing confusion is *S. sanguineum*, but *S. striolatum* has yellow stripes on the legs in both sexes. Males are paler red, have a less waisted abdomen, and the black markings on segments 8 and 9 are less prominent. The adult flies from late June and continues into mid-November or later, if the weather is mild.

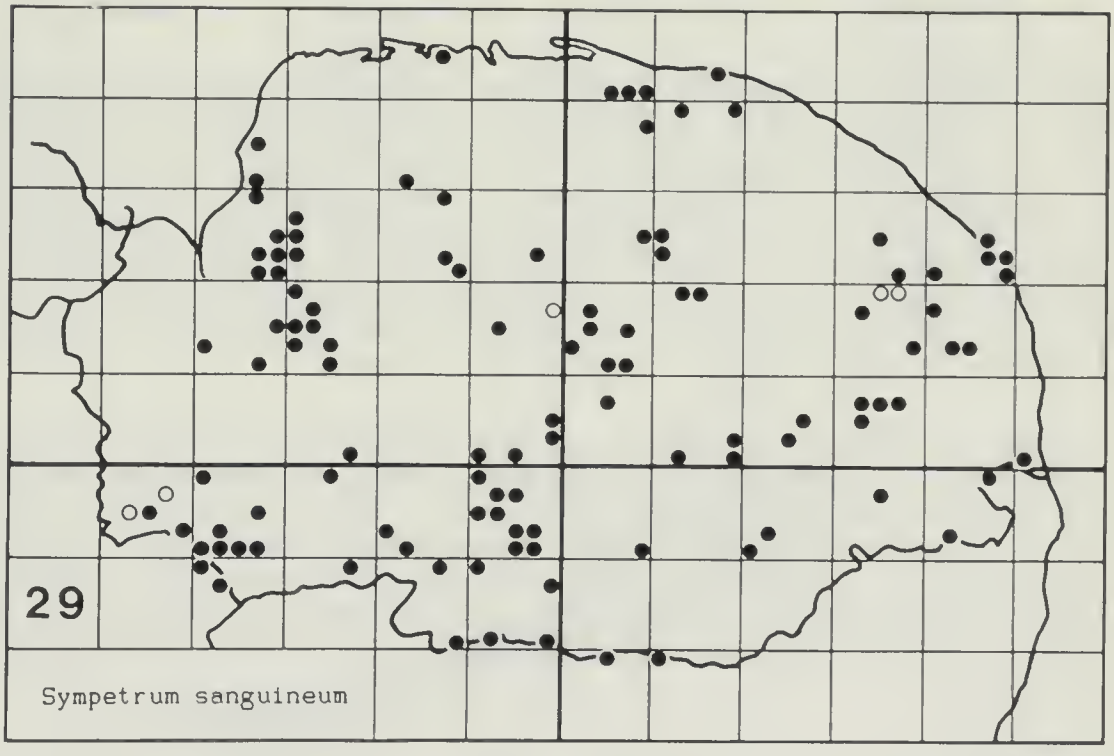
Sympetrum flaveolum (Fig. 28)

The **yellow-winged darter** is a very rare migrant from the continent, arriving from mid July through August. There have been only three records during the eighties, but the species may well have been overlooked. It is generally similar to *S. striolatum* in thorax, abdomen, and leg colouration, but has large yellow patches on the hind-wings, and narrower patches halfway along the forewings, in both sexes. It is much more likely to settle on tall vegetation than other *Sympetrum*, generally about halfway up. It flies weakly, usually over short distances, and hunts over vegetation rather than water. A colony of this species became established at Alderfen from 1945-47 (Ellis, 1948).

Sympetrum sanguineum (Fig. 29)

The **ruddy darter** is more localised than *S. striolatum* in Norfolk but still widespread and apparently increasing. It has a preference for woodland situations. Males are not so territorial as other *Sympetrum*, and where found, may be in quite high





densities. They are easily approached, and will fly only a short distance if disturbed, soon settling on pale surfaces on the ground or on low vegetation. The dragonfly is on the wing from the end of June until the end of August or mid-September. Males are much darker red than *S. striolatum* with very waisted abdomens. Both males and females have all black legs.

Sympetrum danae (Fig. 30)

The **black darter** is very scarce in Norfolk due to its preference for acid bogs usually with active *Sphagnum* growth. The East Norfolk records are of single males, and there is no evidence of breeding away from the West Norfolk sites. Males are not very territorial and can be approached closely. When taking flight they soon settle again on low vegetation or on the ground. They fly from early July to the end of September, sometimes even later if the weather is warm. *S. danae* should not be confused with any species in our area except possibly mature females of *O. coerulescens* late in the season when they look very black. If in doubt, look at the pterostigma. It is black in *S. danae*, and pale orange in *O. coerulescens*.

Several other species have been recorded in the literature as occurring in Norfolk. They include *Ischnura pumilio* (see Lucas, 1900b), *Platycnemus pennipes* (see Curtis, 1838) and *Cordulegaster boltoni* (see Barrett, 1900). Neither these records nor later reports have been substantiated, and so these species should not appear on the Norfolk list. However in 1823, J. Sparshall took a specimen of *Pantala flavescens* at Horning (Askew, 1988). It seems that this constitutes the first, and only, British record of this circum-tropical migratory species which occasionally turns up in Europe.

Acknowledgements

Our foremost thanks must go to the field-workers whose efforts generated the records on which this paper is based. Their task was made easier by the kind co-operation of very many landowners, both public and private. Bob Merritt, who was the Odonata Recording Scheme Organiser during most of the survey, gave his help and advice freely, and the staff of the Biological Records Centre at Monks Wood helped in many ways. Howard Mendel kindly made available to us the interim results of the Suffolk Dragonfly Survey which was running concurrently. Trisha Irwin and Pamela Craske helped with the preparation of maps.

The following recorders contributed post-1979 records.

P.A. Adams
R. Addington
R. Aldridge
K.N.A. Alexander
R. Andrews
A. Archer-Lock
W. Arthurton
M. Ausden
M. Averill
A. Baker
R.E. Baker
P. Beldon
J.P. Benstead
I.G. Black
E.F. Boosey
N. Bostock
C.G.R. Bowden
W. Boyd
M.A. Brewster
J.A. Brydson
D. Buckingham
A.L. Bull
B.N. Carman
N.S. Carmichael
P.J. Cawley
A. Chamberalin
M. Clark
D. Cooper
E.J. Cross
S.A. Cross
C. Dack
S.R. Davy
L. Dear
C. Doarks
N.J. Donnithorne
R.J. Driscoll
R.H. Dunn
K.C. Durrant
Y. Dutton
J.C. Eaton
H.C. Eve
D. Fagg
L Farrell
F.J.L. Farrow
J. Fenton
R. Fenton
K.M. Ferroussat
R.A. Filby
G.N. Foster
J.E. Gaffney
J.D. Geeson
J.E. Geeson
M. Gibbons
N. Gibbons
D.J. Gibbs
J.G. Goldsmith
L. Gregory
D. Hammersley
P.H. Hardie
B.D. Harding
R. Harvey
P.J. Heath
D.J. Hewitt
P.N. Hewitt
R.N. Hill
D.J. Holman
G.P. Hooton
S. Hooton
A.C. Hubbard
A.G. Irwin
N. Jackson
J.R.E. Jones
R.E. Jones
P. Keeler
S. Lake
P.A. Limb
D. Lester
I. Loades
J. Masson
D. Maxey
H. Mendel
R. Merritt
N.W. Moore
D. Miller
P.J. Milford
D. Mussell
C. Nicholls
G. Nobes
K.W.K. Palmer
M. Palmer
A.J. Parr
S. Plant
T. Plant
R. Pointer
P.A.J. Pratley
B.D. Pummell
B.E. Pummell
D. Radley
D.A. Ratcliffe
B. Redman
C. Regan
D.I. Richmond
C. Robinson
R.H. Rogers
F.J. Russell
E.P. Ryan
K.G. Saul
C.J.W. Sayer
H. Scott
W.A. Seaby
C.R. Sergeant
G. Shortland
D.A. Showler
N. Sills
R. Skeen
M. Skipper
R. Smith
R. Southwood
C.R. Stevenson
L. Steward
S. Steward
A.J. Stones
L. Street
A. Taylor
G. Taylor
M. Taylor
M.P. Taylor
P. Taylor
S.C. Thomas
J. Tooley
R.E. Turrell
G.A. Tyler
W. Urwin
D.J. Weaver
A.J. Weir
I. White
M. White
G.F. Wildridge
P.H.G. Wilson
P. Withers

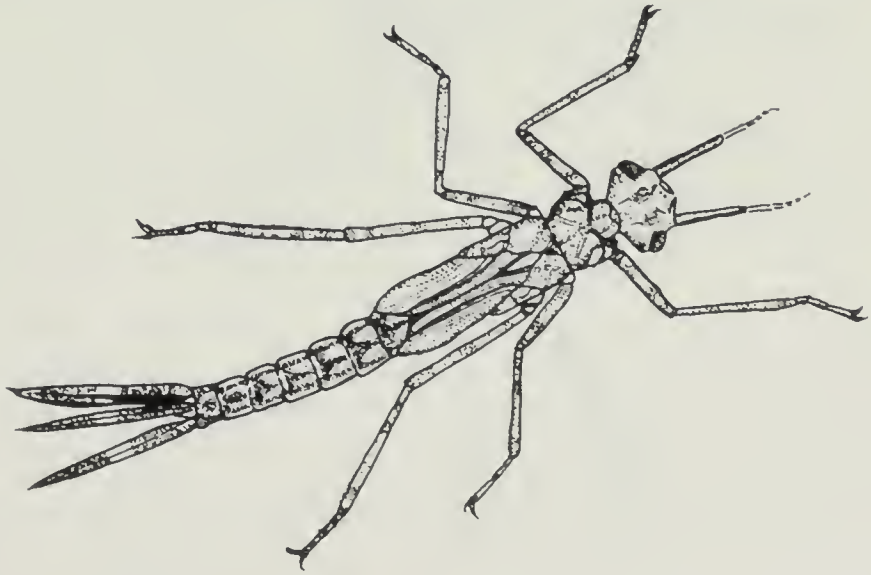


Fig. 31. *Calopteryx virgo* larva.

References

ASKEW, R. R. 1988 *The Dragonflies of Europe*. Colchester: Harley Books.

BALFOUR-BROWNE, F. 1904 Bionomical investigation of the Norfolk Broads. *Trans Norfolk Norwich Nat. Soc.* **7**, 661-673.

BARRETT, C. 1900 Insects. Odonata. in: Rye, W. (ed.) *Victoria County History*, (p. 93).

BATH, W. H. 1890 *An illustrated handbook of British dragonflies*. London: E.W. Allen.

BATH, W. H. 1892 Some famous collecting-grounds for dragonflies. III.—The Fen district. *Hardwicke's Science Gossip* **329** (May 1892), 97-98.

CORBET, P. S., LONGFIELD, C. & MOORE, N. W. 1960 *Dragonflies*. London: Collins.

CURTIS, J. 1838 *British Entomology* **15**(712,732).

DOARKS, C. 1990 *Changes in the flora of grazing marsh dykes in Broadland, between 1972-74 and 1988-89*. Unpublished report to Nature Conservancy Council.

DRISCOLL, R. J., *Aeshna isosceles (Mull.): A survey of some Broadland sites, 8-10 July 1983*. Unpublished report.

DURRANT, K. C. 1960 Rare dragonflies in Norfolk. *Trans. Norfolk Norwich Nat. Soc.* **19**(2), 76-77.

ELLIS, A. E. 1948 Fauna and flora of Norfolk. Dragonflies. *Trans. Norfolk Norwich Nat. Soc.* **16**(4), 331-332.

ELLIS, E. A. 1965 *The Broads*. London: Collins.

HAMMOND, C. O. 1977 *The Dragonflies of Great Britain and Ireland*. London: Curwen Press (Revised edn. 1985, Harley Books).

ISMAY, J. & WRIGHT, P. A. 1975 *Report on the Norfolk Dragonfly Survey 1975*. Unpublished report.

LONGFIELD, C. 1949 *The Dragonflies of the British Isles*. London: Warne.

LUCAS, W. J. 1900a *British Dragonflies (Odonata)*. London: L. Upcott Gill.

LUCAS, W. J. 1900b *Ischnura pumilio*. *Entomologist* **33**, 201.

MERRITT, R., 1985 *A survey of some Broadland sites for larvae of Aeshna isosceles (Mull.) 29-30 May 1983 and 9-11 June 1984*. Unpublished report.

Fig. 32. *Lestes dryas* male.

SALT WATER PENETRATION INTO THE UPPER BURE

Keith Clarke

School of Environmental Sciences, University of East Anglia

Abstract

Fifty years of daily salt records from the East Anglian Water Company's intake at Horning have thrown light on the reasons for sea water penetrating into the Bure valley and its broads.

The predicted tides have little effect on the arrival of salt water although salt water tends to remain longer in the period following spring tides when the tidal range is decreasing.

Comparison of surge records for the North Sea with the salt records showed that certain surge types could be relied upon to cause salt water to arrive at Horning. In the ten year period examined there were certain incursions which were not accounted for by the published list of surges. However, when the daily weather maps of the period were checked it was found that many of these unaccounted for incursions followed weather conditions which would have given rise to surges.

This still left salt incusions in the summers of 1934 and 1935 to be accounted for. The worst drought period this century was 1933 to 1935 and it seems likely that low river flow combined with high evaporation to reduce landwater flow to the lower estuary.

Introduction

The Bure valley broads are generally thought of as freshwater lakes but this is not quite the case. They are part of a tidal estuary and from time to time brackish water comes up the river, enters some of the broads and floods over reed-beds. It can persist for weeks or months. The arrival of brackish water must seriously affect the wild-life of the water and the wetlands.

The most obvious of these effects is the death of fish which are trapped by the arrival of the salt water. Incidents such as the massive fish deaths at Potter Heigham on 1 March 1987 attract the attention of the news media but there are many unpublicised deaths when salt water overflows a whole area and cuts off the fish which have taken refuge in the marsh dykes.

The relationship between salinity of the water and the presence of the fish-killing alga *Prymnesium parvum* is well-known (Holdway, Watson & Moss, 1978). *Prymnesium* has not been detected in the Bure above Thurne Mouth although it is present in the Thurne. It seems possible with the alga established in the River Thurne that if 1935 were to be repeated *Prymnesium parvum* could establish itself also in the Bure broads.

Ellis (1965) attributed the large range of planktonic animals in Broadland to the varying salinity of the broads. Salinity in the Bure has been known to affect Polyzoa (Hurrell 1943) and other invertebrates such as Crustacea (Gurney 1929)

The effects on plant life may be more far-reaching than is at first evident. It used to be said that salt tides were "good for the reed" but no-one seems to have speculated on whether the rich fen flora of the Bure valley is affected by occasional flooding by salt water.

Whether the algae of the Bure plankton are fundamentally changed by incursions of brackish water is a matter of conjecture. Diatoms, which form the bulk

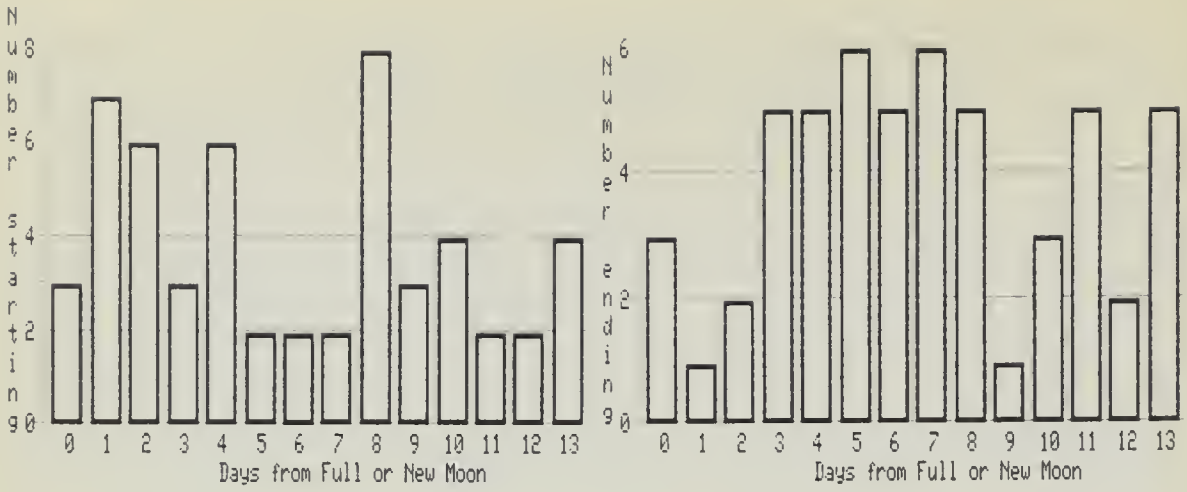


Fig.1 Effect of astronomical tides on salt water incursions. Fifty-four salt incursions were examined. Date of starting and ending of salt period at Horning Works related to the phases of the moon. Springs occur 1-2 days after full or new moon.

of the phytoplankton in these waters, are known to be good indicators of salinity changes. Recently several species of live marine diatoms were found in a sample of the River Bure at Church Bend, Horning.

Before we can begin to understand the effect of salt water in the Bure valley and broads we need to know more about the causes of the salt water incursions into the Broads and their likely frequency. This paper, using the Horning salt records, looks at these factors.

Horning intake (TG359163) is on the River Bure about 20 miles from the sea close to Horning church, in the middle of the Norfolk Broads area. Records of the highest and lowest salt values each day were kept by the enginemen at Horning Pumping Station from 1920 until the station ceased to be fully manned about 1970. These records can throw light on the causes of salt water penetrating to Horning.

The water company must, by their special Act of Parliament, cease abstraction from the river at Horning when the salt content exceeds "twenty grains of chlorine per gallon". This meant, for instance that they had to cease abstraction in 1935 for ten weeks.

It is easy to name the factors which could determine the penetration of salt water, but it is more difficult to say the amount of influence which each factor has on the problem. It is necessary to examine the effects of river flow, tides, storm surge and pressure and to say which of them and in what combination, cause the salt incursions.

Materials and methods

Horning pumping station was manned continuously from 1917 to the early 1970s. During this time, because of the legal requirement to cease abstraction at 20 grains per gallon of chlorides, a regular check (several times a day) was kept on the salinity of the river by the enginemen using silver nitrate titration with potassium chromate as an indicator. They recorded the maximum and minimum daily reading in the station log.

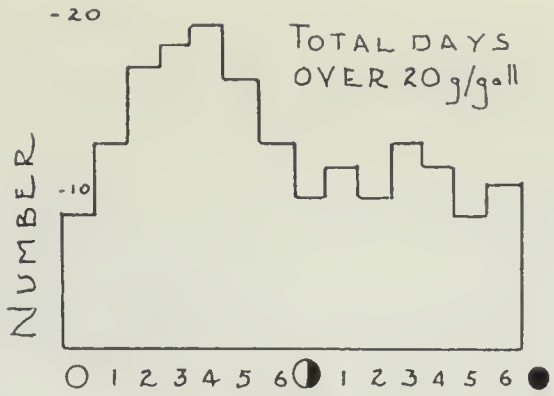


Fig. 2 Total days salt related to days from full and new moon or half moon. Note the tendency of salt to hang in the river following spring tides. The histogram covers the eleven year period 1942—1952.

Most of these logs have been retained with values given in grains per gallon. Since 1948 a recording tide gauge has been maintined there. For some years it was the practice to hire a motor launch when salt water arrived at the intake in substantial amounts and take a series of samples upstream to see how far the salt water went. This was done with the idea that the intake might be moved to the Hoveton area. When a second intake was established on the River Bure at Belaugh (TG285188) near the head of the tidal estuary these salt records were superfluous but fortunately they were stored by the Water Company.

Following severe flooding in London due to high tides, the Liverpool Tidal Institute was asked to report on the causes. Corkan (1948) produced a very full report in which he listed most of the surges in the eleven year period 1928-1938. He also used a system of classification of North Sea surge by place of origin which has proved valuable in this investigation.

Weather maps used were the daily synoptic charts produced by the Air Ministry Meteorological Office (as it then was) and kindly made available by their library.

River flow figures were not available for the River Bure until commissioning of the Ingworth gauge in June 1959. Previous to that date the flow of the Essex Stour was used. A comparison with other gauged East Anglian rivers, the Chelmer, Blackwater, Lark and Lee indicated the fair degree of reliability which could be placed on using the Stour figures for the Bure.

Results

Predicted tides

The period 1942 to 1952 inclusive was chosen to study the effect of the predicted tides on salt incursions. Those over 286 mg l^{-1} (20 grains per gallon, the statutary water abstraction limit) were used and the dates of beginning and end of the "outbreak" together with its duration were studied. Fresh water entering the estuary from the river has a mean chloride level of 56 mg l^{-1}.

There were 54 outbreaks in the period and if they were caused by spring tides you could expect them to occur just after new and full moon. But this is not the case. Fig 1 shows that there is no relation to the phases of the moon. Similarly the days with salt over 286 mg l^{-1} Cl are plotted for each day of the lunar cycle (Fig. 2).

Fig. 3 Monthly distribution of salt incursions if surge-generated outbreaks are excluded. The histogram covers the eleven-year period 1942—1952

River flow

It was obvious from inspection of the data that low river flow was not a major factor in causing salt incursions, indeed the largest salt incursions occurred at times of high river flow. If we put river flow aside we can return to it later after considering the effect of storm surges in the North Sea.

Storm surge

It has been common knowledge since the floods of 31 January 1953 that northerly gales in the North Sea cause considerable rises in sea level. Details of the propagation of that surge have been given by Rositter (1954) and an earlier one of 8 January 1949 was studied in detail by Corkan (1950).

Corkan (1948) published a record of surges from 1928 to 1938. In examining this record, I have not plotted surges for the year 1938. The dunes at Horsey were breached by the sea early in that year (Mosby et al. 1939) and conditions were most unusual due to the introduction of so much salt water into the Hickling-Horsey area.

The connection betwen storm surge and salt penetration is quite remarkable. Corkan records 36 surges caused by northerly gales in the North Sea or the Norwegian Sea during the ten year period. Of these 36 surges, 27 gave very substantial salt penetration, 3 gave slight penetration and 7 gave none. Of these seven, three were preceded by a surge caused by southerly gales which lowered the level of the North Sea.

A kind of surge which produces a quick rise and fall of sea level and which is not associated with northerly gales did not cause salt water incursions into the Broads.

Some of the salt incursions, which did not arise from surges listed by Corkan (1948) looked suspiciously like surge incursions and so the weather maps were examined for 13 cases. Every one proved to be associated with northerly gales and it can be calculated that substantial surge must have occurred at those times. The surges had been omitted from the list in Corkan (1948).

River flow

Surge is not the complete answer to salt penetration of the estuary. In all, during the 10 year period chosen there were 88 incursions of salt water of which 54 were caused by surge. This is well over half the total. The monthly occurrence of unaccounted-for surges (Fig 3) is mostly confined to the autumn, the time when

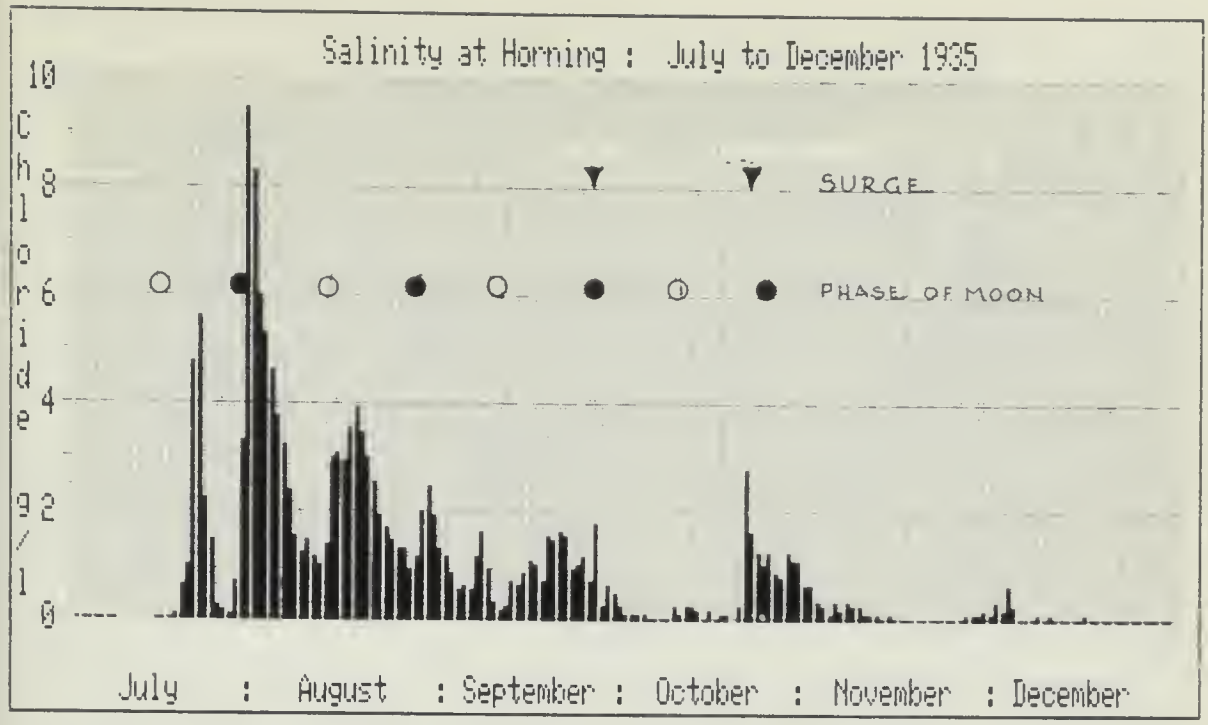


Fig. 4 Records, for the second half of 1935, of salt at Horning intake, surge and moon's phases. Note the relation to astronomic tides when the river flow is very low. This gives symmetrical salt peaks, quite different from the surge induced incursion of 20 October.

river flows are normally at their lowest. It is possible to point to long periods when the Essex Stour flow was below 0.6 cubic metres per second without salt penetrating to Horning (e.g. June and July 1934). It does however appear that when the river flow drops to 0.6 m^3 sec^{-1} in the Stour, spring tides can bring salt water up to Horning. A considerable period of low river flow is needed for this to happen due to the reservoir effect of stored water in the Bure Valley broads.

The record for 1935 (Fig 4) illustrates the effect of low flow. A peak follows both the July and August spring tides and these peaks have a different shape from those which follow surge. They are symmetrical peaks, very different from the surge induced peaks which have the sudden rise followed by exponential decrease which can be seen, for instance after the surge of 20 October 1935 on Fig 4.

To understand what may be happening at times of low flow we must look at the conditions which obtain. An investigation by the River Authority and the Water Company in the 1960s concluded that, at times of severe drought it must be assumed that there would be a river flow of 11 million gallons per day at Belaugh or 50,000 m^3/day.

The River Bure and broads above Ant Mouth have an area of 2.4 km^2. Mean daily evaporation for the driest month measured at Ormesby in the last 70 years was 3.47mm. This represents a daily loss of 8,328 m^3 from the river and Bure broads.

In the 1930s the pumping station could extract 14,000 m^3/day although abstraction ceased as soon as salt water reached the intake at Horning.

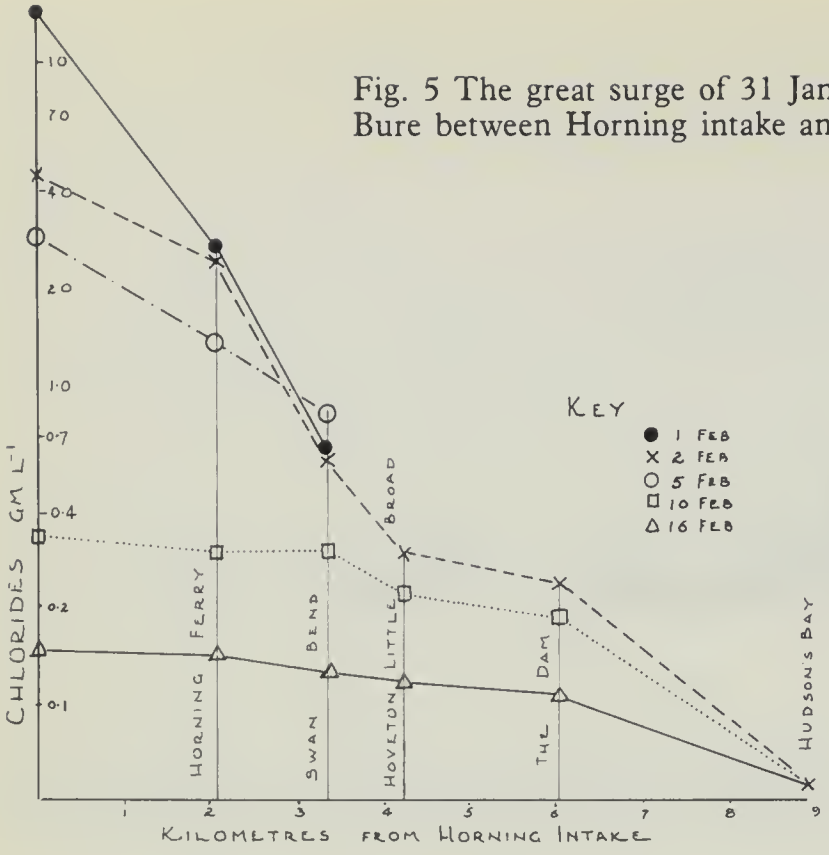


Fig. 5 The great surge of 31 January 1953 in the River Bure between Horning intake and Wroxham.

Evaporation from the 5.5 km^2 of reedbeds is difficult to estimate but Parker (1932) has stated that meadow grass requires up to 7.2 mm of water per day and reed must be much in excess of this. Using the figure of 7.2 mm/day we would require 39,600 m^3/day to satisfy the needs of the reed-beds. We thus arrive at the following water balance.

	m^3/day	m^3/day
Inflow from river	50,000	
Evaporation from water		8,328
Evaporation from reed-beds		39,600
Abstraction by waterworks		14,000
		61,928
Flow deficit at Ant Mouth		11,928

It can be argued that the soil moisture deficit in the reedbeds would not be made good and that the land round the broads would contribute a certain amount of groundwater inflow. But it does appear that at times of extreme drought the net flow seaward, must be inadequate to keep the salt water at bay.

Penetration beyond Horning

On every major salt incursion from 1938 to 1965, a salinity survey was carried out along the river upstream of Horning Pumping Station. Fig. 5 shows the effect of

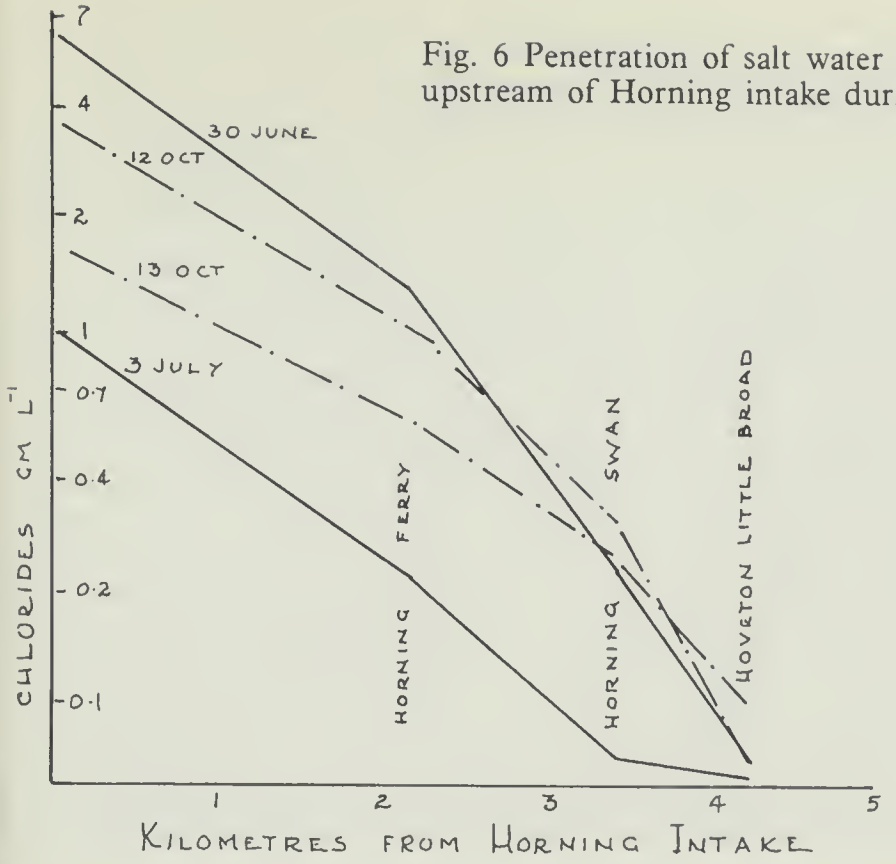


Fig. 6 Penetration of salt water into the River Bure upstream of Horning intake during 1960.

the great surge of 31 January 1953 and Fig. 6 shows the penetration of various surges in 1960. It is striking from the latter that the salinity-length curves have roughly the same slope regardless of the initial value of the salt and regardless of the river flow.

Clearing of salt

The departure of salt water from the upper river after a surge incursion can be studied from the Horning records. Salt water can enter the lower Bure broads. Fortunately the broads which the salt enters are downstream of the intake point so we are dealing there with a relatively uncomplicated salt-dilution situation. The clearing of several surges is shown in Fig. 7 from which it can be seen that there is considerable variation in flushing times. There is no apparent connection between flushing times and river flow.

The two steepest of the clearance curves, for 10 November 1944 and 21 September 1948, which are almost parallel, give retention times of less than a day. They correspond to gross mean flows in the Stour of 5.94 $m^3 s^{-1}$ and 0.62 $m^3 s^{-1}$ respectively. Similarly the flatter pair of curves with retention times of 3.5 to 4 days had flows of 5.12 $m^3 s^{-1}$ (1 Feb 53) and 0.776 $m^3 s^{-1}$ (20 Oct 35).

Moss et al. (1989) studied in detail some occasions when salt water penetrated Malthouse, Ranworth and South Walsham Broads. They were able to use the results to calculate retention times for these broads and for the river. They found low retention times (less than a day) above Horning but at Ranworth Marshes and below St Benets Abbey retention times were several weeks in summer.

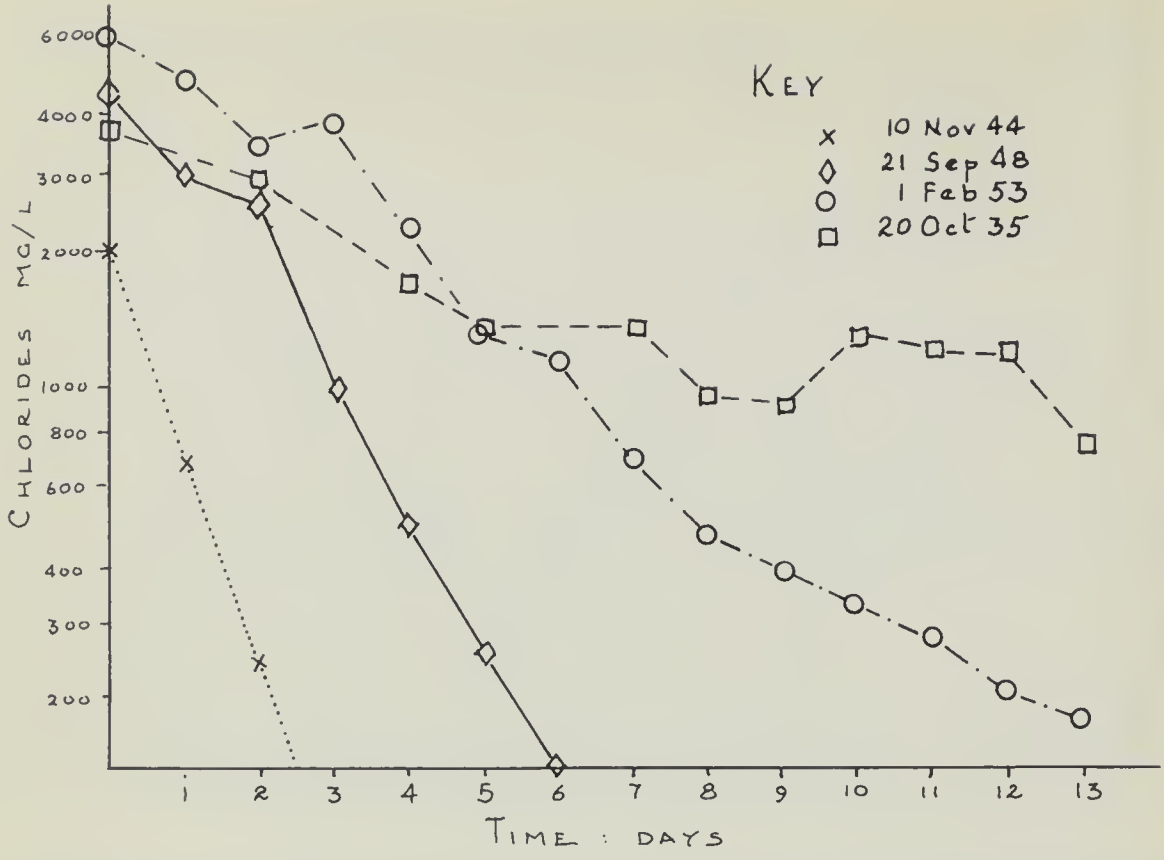


Fig. 7 Clearing of salt from the River Bure at Horning intake following introduction by storm surge. The very slow clearance for 20 October 1935 is the first surge induced incursion following the long drought period.

Discussion

Study of the Horning salt records has shown that we can predict salt incursions from certain surge types and also when dry conditions have prevailed for a long period. With this knowledge it is possible to anticipate the arrival of salt and be prepared for a more intensive study of the mechanisms involved. Much of this investigation suffers from the absence of figures for the flow of the River Bure. Now that a long period of gauging records is available for the river it should be possible to investigate this factor in more detail and greater use could be made of the records of the recording tide gauge at Horning.

Three fields of investigation suggest themselves immediately. They are:

1. The hydrodynamics of mixing in the lower Bure between Stokesby and the sea and what effect storm surge has on this process. We need to know the origin of the influx of salt. To what extent is this water derived directly from the sea? It is also important to know how much of the Thurne water comes back into the Bure on the next flood tide. The experiments of Moss *et al.* (1989) point to a complex situation there.

2. The effect of salt water entering the lower Bure Broads is of great interest. To what extent do they behave as brackish lagoons?

3. The behaviour of the tide in the upper Bure estuary based on an investigation of the Horning tide records. Especially interesting here is the effect on the tide of flooding of the fens alongside the river. At higher water levels the Bure Broads area becomes a huge lake and this must change the behaviour of water movement very considerably.

The above should lead to a better understanding of the situation but concurrently research is needed into the effects on the plankton, the reaction of fish stocks to the salt incursions, and the influence that inundation with salt water has on the unique fen flora of the area.

These are not purely academic questions. Two factors cause the waterworks to use the Belaugh rather than the Horning intake: the high algal load and the danger that salt water will suddenly appear at the Horning intake and cause an unplanned change of source. The present investigation permits better prediction of the arrival and departure of salt water there. When water movement within the Bure Broads area is understood it should throw light on the development of the large algal crops which simple reasoning would lead us not to expect. Understanding of these crops whould help in reducing numbers at the Horning intake.

It is likely that the building of the Great Yarmouth surge barrier will have to be reconsidered if sea level changes are expected at anything like the rates currently being put forward. Operation of the barrier could be made to exclude salt incursions. But before a barrier is operated in this way it is essential to know what the implications would be. To what extent do the broads rely on occasional salt incursions for their unique character?

Acknowledgements

I am grateful to the Chief Engineer and General Manager of East Anglian Water Company for permission to publish the Horning data and to Susan Catchpole for unearthing missing material. Hugh Ramsey, at that time Chief Engineer of South Essex Water Company, patiently supplied me with masses of data from the Essex Stour. In the early part of this investigation I was greatly helped by Dr Doodson, the Director of the Liverpool Tidal Institute, who lent me the two volumes of Corkan's 1948 report to the London County Council. Prof. B. Moss kindly studied the manuscript and made a number of useful comments.

References

CORKAN, R.T. 1948 *Storm Surges in the North Sea.* 2 vols Washington D.C., H.O.Misc. 15072

CORKAN, R.T. 1950 Levels in the North Sea associated with the storm disturbance of 8 January 1949. *Philosophical Transactions of the Royal Society Series A* **242**, 493

ELLIS, E.A. 1965 *The Broads.* London: Collins

GURNEY, R. 1929 The freshwater Crustacea of Norfolk. *Trans. Norfolk Norwich Nat. Soc.* **12**, 550

HOLDWAY, P.A., WATSON, R.A. & MOSS, B. 1978 Aspects of the ecology of *Prymnesium parvum* (Haptophyta) and water chemistry in the Norfolk Broads, England. *Freshwater Biology* **8**, 295-311

HURRELL, H.E. 1943 Pond life. *Trans. Norfolk Norwich Nat. Soc.* **15**, 319

MOSBY, J.E.G., BUXTON A., SAINTY J.E. & ELLIS E.A. 1939 The Norfolk sea floods. *Trans. Norfolk Norwich Nat. Soc.* **14**, 334-390

MOSS, B., BOOKER, I., BALLS, H., & MANSON, K. 1989 Phytoplankton distribution in a temperate floodplain lake and river system. I. Hydrology, nutrient sources and phytoplankton biomass. *Journal of Plankton Research* **11**, 813-836

PARKER, P.A.M. 1932 *The Control of Water.* London: Routledge

ROSSITER, J.R. 1954 The North Sea Storm Surge of 1 February 1953. *Philosphical Transactions of the Royal Society Series A* **246**, 371-400

DOLICHOVESPULA MEDIA - A SOCIAL WASP NEW TO EAST ANGLIA

A.G. Irwin

Castle Museum, Norwich NR1 3JU

Many of us pay little attention to wasps, except to ensure that they stay out of our clothes and jam sandwiches. Others take a keen interest, believing that they have a vocational duty to kill every wasp they see. It was refreshing therefore, when I received a jar containing a portion of wasps' nest which had been rescued after it became detached from a nest in a *Viburnum tinus* bush in a Reedham garden (TG422018). The nest portion was found on 18 June 1990 by Deda Francis, who fed the emerging workers on honey, and passed them onto Rex Hancy. Having difficulty in identifying the species, Rex passed the jar on to me. The workers were considerably larger and blacker than those of common wasp, and I did not recognise them either. However reference to Falk (1981) and Allen and Archer (1989) showed the species to be *Dolichovespula media* (Retzius).

This species was first recorded as British from a male found in Sussex in 1980. Since then, it has been discovered in other Sussex localities and in Kent and Surrey, but there have been no previous records from East Anglia (Else, 1989 & pers. comm.). Whether this is a spreading species, or whether it has been just over-looked is a matter for conjecture, but I would welcome any further records from East Anglia. Voucher specimens of the wasps have been deposited in the Norwich Castle Museum collections (accession no. 176.990). The species can be distinguished from the other British *Dolichovespula* (long-cheeked social wasps) by the completely yellow eye-notches (Fig. 1). In other *Dolichovespula* the eye notches are all black or have only a narrow band of yellow on the lower margin (Fig. 2). *D. media* is intermediate in size between other wasps and the hornet, and the workers are often, though not always, extensively black on the abdomen.

Figs. 1 & 2. *Dolichovespula* head patterns (hairs and antennae omitted for clarity).
1. *D. media*.
2. *D. norvegica*

Acknowledgements

I thank Deda Francis for details about the nest and for having such an enlightened attitude towards wasps. I also thank Rex Hancy for bringing this exciting discovery to my notice, and George Else (British Museum (Natural History)) for the latest information on the distribution of *D. media*.

References

ALLEN, G.W. & ARCHER, M.E. 1989 *Dolichovespula saxicola* (Fabricius, 1793) (Hym., Vespidae) found in Britain, with a key to British *Dolichovespula*. *Entomologist's mon. Mag.* **125**, 103-105.

ELSE, G.R. 1989 *Dolichovespula media* (Retzius) (Hym., Vespidae) resident in south-east England. *Entomologist's mon. Mag.* **125**, 106.

FALK, S. 1982 *Dolichovespula media* (Retzius)—a new British social wasp. *Proc. Trans. Br. ent. nat. Hist. Soc.* **15**, 14-16.

SEVEN YEARS OF MOTH RECORDS FROM SCOLE—FROM 1981 TO 1987

Michael R. Hall

"Hopefield", Norwich Road, Scole, Diss, Norfolk, IP21 4DY

The moth species recorded at Scole fall into four broad categories. The majority comprise the widely distributed species that can be found throughout much of eastern and midland England. The second category includes more localised species that are either restricted to the specific type of habitat or geographical area—site related species. Thirdly there are the expected, but nevertheless irregular and exciting, migrants. The final group includes moths that seem out of context and may indicate such things as a species spreading, a previously unrecognised location or perhaps habitat, or an association with an unsuspected larval foodplant etc. Whilst this fourth category probably gives rise to the most excitement and speculation, changes in numbers of individuals of a species, or the frequency of appearance of moths from the first category are equally interesting.

The site

The study site is the lower part of a gentle, western facing slope, broadly within the Waveney valley, at the edge of the village of Scole (TM151792). It looks out across a small, often dry, side valley, to open farmland which is well hedged. The river itself is half a mile away to the south and there are two small remnants of ancient woodland within two miles—to the north and east respectively. In the winter of 1980/81 it was decided to allow a small part of a one and a half acre holding to tumble down to grass. This was the area at the bottom of the slope, which had always been damp, and difficult to keep clean. The ultimate aim was to create a small copse. It would be very small as the area concerned is only 50 metres by 15 metres, but planting of native tree species was started. In the 1980/81 winter oak, ash, hazel, aspen, sallow, willow, field maple and silver birch were planted. All were either one or two years old and had been raised from seed. Some died, but the majority lived, and in subsequent winters lime, scots pine, more ash and oak, as well as shrub species such as blackthorn, dogwood, spindle, and buckthorn were added, with several small hawthorns appearing by natural invasion. During the early part of 1986 the 'tumble down' area was almost doubled, but this extra part remained as grass and was grazed regularly by sheep. At the same time a pond was dug in the lowest part of the study area. Although not large, it has a surface area of some 75 square metres and a maximum depth of just under a metre and a half. After seven years the trees and shrubs are clearly visible, with some, like the silver birch, over twelve feet tall, but certainly it is not yet woodland.

The remainder of the holding is managed to produce some market garden crops, both vegetables and flowers. It has an area of top and soft fruit, with sheep and poultry utilising much of the grass access paths, and there is a small apiary.

The recording regime

Prior to 1981 trapping and recording moths had been on a somewhat irregular basis. From 1981 the recording has been carried out on an almost daily basis—with the traps set in the embryo woodland area. Records from 1981 to 1984 were from two Heath traps, operating from the mains, and virtually at each side of the small 'woodland' area. Since 1985 the records have been from a single Robinson trap,

with a 125 watt mv bulb, more or less centrally placed in the study area. All traps have been run through time switches, being in operation from dusk until dawn.

Generally distributed species

The majority of species recorded are those that would be expected from what was virtually a small arable field in a relatively unspoilt rural area. These are the common, and generally widespread, moths which have adapted to a variety of habitats, and often larval foodplants as well. The melanic form of the pale brindled beauty *Apocheima pilosaria*, and the dark variation *Apamea crenata combusta* of the clouded-bordered brindle caused initial puzzlement, as did the mites, which I now understand are quite common, feeding from the veins on one forewing of a pale mottled willow *Caradrina clavipalpis*.

As with any continuous trapping and recording programme new species have been regularly added to the site list, and at the end of 1987 the total number of species was in excess of 380. Some, like the old lady *Mormo maura*, which was recorded on 24 August 1986, and the mullein *Cucullia verbasci* on 9 May 1986, have been seen only once. These species are infrequent visitors to light traps and thus singleton records are expected. Many others, like the heart and dart *Agrotis exclamationis*, burnished brass *Diachrysia chrysitis*, pale brindled beauty *Apocheima pilosaria*, etc. have been regular, and consistent visitors. However, several species that were regular, consistent, and in moderately large numbers—between 5 and 20 per night when they were flying—during the first years of the trapping programme have declined markedly in the last two years. The most noticeable of these has been the shuttle-shaped dart *Agrotis puta*, which was in good numbers until 1986, was greatly reduced in that year and hardly seen at all in 1987. Less dramatic, but similar declines have been noticed with the white ermine *Spilosoma lubricipeda*, garden dart *Euxoa nigricans*, dark arches *Apamea monoglypha*, light arches *Apamea lithoxylea*, dusky brocade *Apamea remissa*, common rustic *Mesapamea secalis* (no differentiation has been made between the common rustic and the lesser common rustic *Mesapamea secalella* as all early records are for the species aggregate), and the flounced rustic *Hydraecia micacea*. There is an indication that the clouded drab *Orthosia incerta* is also beginning to decline as this usually plentiful species has not been so numerous in 1987. Both the dark arches and the common rustic are still well represented in the current records but numbers are very much below the high levels noted until 1986. In that year 127 dark arches and 68 common rustics were recorded on 30 July. Although these were the highest numbers recorded, catches in the twenties and thirties were normal, and had been in the previous five years. In 1987 both these species only turned up in twos and threes.

Whilst one group of species appear to have been declining in numbers, others have been increasing. There are not so many of these, and the increases have not been as great as the decreases. The most noticeable have been the rustic shoulder-knot *Apamea sordens* and the large nutmeg *Apamea anceps*. It is interesting that both these species belong to the same genus as several of the declining species. All overwinter as larvae which are said to feed on grasses. The grass feeding swift moths have also been much more in evidence in 1986 and 1987 — not so much as specimens in the trap, but seen dancing over the grass at dusk, particularly male ghost moths *Hepialus humuli*. Another species that has also become more numerous since 1985 is the small elephant hawk-moth *Deiliphila porcellus*. This species also seems to have been occurring more frequently at other trapping sites throughout the county.

In addition to the trends mentioned above, one or two species have been fluctuating up and down during the recording period. Particularly noticeable among these has been the scalloped hazel *Odontopera bidentata* which was recorded in very low numbers between 1983 and 1986, and the bird's wing *Dypterygia scabriuscula*, which has been recorded in threes and fours every other year. The declining and increasing species discussed in the preceding paragraphs may also be showing cyclical changes, but over a longer interval.

Species with more specialised habitat requirements

Perhaps the first indication that species generally regarded as requiring something more than the generalised countryside habitat were mobile, and likely to be found at Scole had been much earlier. On 9 June 1981 a single great prominent *Peridea anceps* was found in the trap. This is described as a species inhabiting mature woodland and at the time it was thought of as just an itinerant 'tourist'. As this was very much an isolated record it received only passing comment. However, on 14 April 1987 the first pine beauty *Panolis flammea* was recorded, with the micro *Semiscopis steinkellneriana* appearing the next night. Another two pine beauties appeared in the next week. Just a little later, from the 24 April onwards many more lunar marbled browns *Drymonia ruficornis* than previously recorded, were coming to light, and they continued for nearly a month, until 22 May.

It was not until 28 May 1987 that the first great prominent of that year arrived, but this time, instead of being an isolated visitor it was followed by others on 4 and 8 of June. The exact numbers on 4 June were difficult to determine as the light had also trapped a sparrow, but five forewings were found! On 13 June I recorded the first of a run of the common marbled carpet *Chloroclysta truncata*, although a single, worn specimen had been previously noted on 1 July 1981. Later in June the maple prominent *Ptilodontella cucullina* appeared in ones and twos over a period of a couple of weeks, instead of the singleton from the previous five years. The pine hawk-moth *Hyloicus pinastri* had made its first appearance as a single specimen on 19 July 1986 but there were four in 1987, spread over three weeks.

It was during 1986 that two of the fenland specialities were recorded. On 26 June a single reed dagger *Simyra albovenosa* was found in the trap and on 25 August there was one oblique carpet *Orthonama vittata*. Although the reed dagger is not uncommon where it occurs (Skinner, 1984) it is a very local species and the nearest known site is at Lopham Fen, about 7 miles to the west. Although the oblique carpet is said to be locally widespread throughout much of the British Isles (Skinner, 1984) it does not appear to have been recorded from any of the local Waveney valley river fens in recent years—certainly since 1984. Thus its occurrence at Scole in 1986 is something of a mystery.

In 1987 I recorded my second cream-bordered green pea *Earias clorana*, on 7 July, having seen the only other one almost exactly a year earlier on 14 July 1986. This is also generally regarded as an inhabitant of fenland and other marshy places, but is also known from damp woodlands. However, at about the same time, I recorded a green arches *Anaplectoides prasina*, a species of deciduous woodland, and a blue-bordered carpet *Plemyria rubiginata rubiginata*, another woodland and hedgerow species, both on 11 July. These were followed by a lilac beauty *Apeira syringaria* on 13 July, a small dotted buff *Photedes minima* on 15 July and sharp-angled carpet *Euphyia unangulata* and small fan-footed wave *Idaea biselata* on 16 July. These species, together with the great prominent, and to a lesser extent the common marbled

carpet, are generally described as woodland moths. On 4 and 14 August a double lobed *Apamea ophiogramma*—perhaps the same individual—was another new record for the site. This is a species I would expect to find in fenland and other marshy places, but it too is known from damp woodland.

They were followed by a latticed heath *Semiothisa clathrata clathrata*, barred red *Hylaea fasciaria*, and the tortrix *Croesia forsskaleana*. Again these are all species new to Scole and, whilst not so strictly woodland species as some of those described earlier, are definitely associated with Breckland and coniferous plantations—although they are not necessarily conifer feeders. On 15 July 1981 I had recorded an archer's dart *Agrotis vestigialis*, which is a moth of coastal sandhills, breckland and some other inland heaths. The species is well known from Wortham Ling, an area of acid heathland some five miles to the south west of Scole.

The pale shining brown *Polia bombycina* was recorded on 19 July 1984, 22 July 1985 and 27 June 1986 but not in 1987. Described as a species chiefly inhabiting downland and open country mainly on chalk it is one where the life history in the wild is apparently unknown (Skinner, 1984). Also in 1986, on 18 June, a single small waved umber *Horisme vitalbata* was recorded. This is a species that is also associated with chalky soils, the larva feeding on traveller's-joy. The soils around Scole are by no means chalky, although there is a small patch of traveller's-joy in one hedgerow (probably planted).

From all the species mentioned above, which are more usually associated with a variety of specific habitats rather than being regarded as 'generally distributed', it would seem that many moth species are more mobile than formerly thought.

Irregular, but recognised migrant and wandering species

During the seven years only four species that are regarded solely as migrants have been recorded, with the highlight being a bordered straw *Heliothis peltigera* on 14 July 1986. The others are the humming-bird hawk-moth *Macroglossum stellatarum*, which has appeared in five summers, the dark sword-grass *Agrotis ipsilon*, which has been seen in either the spring or winter each year, and the silver Y *Autographa gamma*, another regular visitor where the numbers in some years have confirmed the presence of a home-bred generation. As well as these four species, for several more of those recorded it is suspected that the resident population is supplemented by immigrants in most years (Skinner, 1984). Among this group is the barred red, which might account for the singleton seen on 2 August 1987, the large thorn *Ennomos autumnaria*, clouded silver *Lomographa temerata*, white satin *Leucoma salicis*, and the straw dot *Rivula sericealis*, which could explain the fluctuations in numbers of all these species.

In previous years I had recorded the odd bulrush wainscot *Nonagria typhae*, large wainscot *Rhizedra lutosa*, and a fen wainscot *Arenostola phragmitidis*, but since the trees and shrubs have started to grow I have not seen any of these species. They were fairly obviously wanderers, as suitable larval foodplants have never grown on the site. Whilst on the subject of larval foodplants the only one mentioned for the small dotted buff is tufted hair-grass which does not grow locally (to my knowledge), so that species may well have also been a wanderer.

Unexpected species

Records of juniper carpet *Thera juniperata*, treble brown spot *Idaea trigeminata*, dotted rustic *Rhyacia simulans*, Blair's shoulder knot *Lithophane leautieri hesperica*,

and the tortricid *Lozataeniodes formasanus*, excited interest as all these species are comparatively new to East Anglia and have recently appeared in this part of Norfolk as their range has increased. The arrival of another unexpected species, the tawny wave *Scopula rubiginata*, on 19 August 1987 caused much excitement as the closest known colonies are in Breckland, over 15 miles away to the west.

Summary

From the species, and numbers, of moths recorded at Scole over a period of seven years it appears that a proportion of the formerly common—sometimes even pest—species is declining quite dramatically. Whether this reflects a general decline, or is specifically related to this site, is difficult to determine. Certainly, general recording field trips throughout Norfolk and Suffolk in the last three years have indicated a similar situation from a number of places. There does not seem to be too much in the way of a compensating rise in numbers for other species. There has been a most definite increase in the number of new species recorded during the last two years of the trapping programme. I do not have either the expertise or the experience to say whether this represents a change in acceptable habitat for these species following an expansion in population; whether it is a case of a niche becoming partially vacant and being filled by different species; whether it is a cyclical change in both the expanding and declining species, or perhaps even a different reaction to long term climatic change; or whether it is just chance. However I intend to continue the study with the hope that a clearer picture may emerge with more records.

The species recorded from Scole (TM151792) from 1981—1987

Nomenclature, and numeration, are from Bradley and Fletcher (1979).

Hepialidae
- 14 *Hepialus humuli* — Ghost Moth
- 15 *Hepialus sylvina* — Orange Swift
- 17 *Hepialus lupulinus* — Common Swift

Cossidae
- 161 *Zeuzera pyrina* — Leopard Moth

Zygaenidae
- 169 *Zygaena filipendulae* — Six-spot Burnet

Tineidae
- 232 *Monopis monachella*
- 237 *Niditinea fuscipunctella*

Choreutidae
- 385 *Anthophila fabriciana*
- 389 *Eutromula pariana*

Yponomeutidae
- 455 *Ypsolopha scabrella*
- 463 *Ypsolopha vittella*

Elachistidae
- 631 *Cosmiotes freyerella*

Oecophoridae
- 648 *Endrosis sarcitrella*
- 658 *Carcina quercana*
- 664 *Diurnea phryganella*
- 667 *Semioscopis steinkellneriana*
- 688 *Agonopterix heracliana*
- 696 *Agonopterix propinquella*
- 697 *Agonopterix arenella*
- 711 *Agonopterix curvipunctosa*

Gelechidae
- 727a *Metzneria aprilella*
- 814 *Scrobipalpa ocellatella*

Blastobasidae
- 874 *Blastobasis decolerella*

Cochylidae
- 937 *Agapeta hamana*
- 938 *Agapeta zoegana*
- 966 *Cochylis atricapitana*

Alucitidae
- 1288 *Alucita hexadactyla*

Tortricidae

970 *Pandemis ceresana*
972 *Pandemis heparana*
977 *Archips podana*
989 *Aphelia paleana*
1001 *Lozotaeniodes formosanus*
1015 *Eulia ministrana*
1032 *Aleimma loeflingiana*
1033 *Tortrix viridana*
1036 *Croesia forsskaleana*
1037 *Croesia holmiana*
1039 *Acleris comariana*
1048 *Acleris variegana*
1063 *Celypha striana*
1064 *Celypha rosaceana*
1068 *Olethreutes rivulana*
1076 *Olethreutes lacunana*
1083 *Hedya nubiferana*
1099 *Endothenia marginana*
1104 *Endothenia quadrimaculana*
1108 *Lobesia abscisana*
1111 *Bactra lancealana*
1115 *Ancylis achatana*
1156 *Epinotia solandriana*
1174 *Epiblema cynosbatella*
1175 *Epiblema uddmanniana*
1183 *Epiblema foenella*

Pyralidae

1293 *Chrysoteuchia culmella*
1294 *Crambus pascuella*
1301 *Crambus nemorella*
1302 *Crambus perlella*
1304 *Agriphila straminella*
1305 *Agriphila tristella*
1306 *Agriphila inquinitella*
1313 *Catoptria pinella*
1328 *Schoenobius gigantella*
1334 *Scoparia ambigualis*
1334a *Scoparia basistrigalis*
1345 *Nymphula nymphaeta*
1348 *Parapoynx stratiotata*
1350 *Parapoynx stagnata*
1356 *Evegestis forficalis*
1376 *Eurrhypara hortulata*
1388 *Udea lutealis*
1392 *Udea olivalis*
1405 *Pleuroptya ruralis*
1413 *Hypsopygia costalis*
1415 *Orthopygia glaucinalis*
1417 *Pyralis farinalis*
1425 *Galleria mellonella*
1428 *Aphomia sociella*
1439 *Eurhodope advenella*
1445 *Oncocera formosa*
1451 *Pyla fusca*
1458 *Myelois cribrella*
1470 *Euzophera pinguis*

Pterophoridae

1513 *Pterophorus pentadactyla* — White Plume Moth

Lasiocampidae

1631 *Poecilocampa populi* — December Moth
1632 *Trichiura crataegi* — Pale Eggar
1634 *Malacosoma neustria* — The Lackey
1637 *Lasiocampa quercus quercus* — Oak Eggar
1640 *Philudoria potatoria* — The Drinker
1642 *Gastropacha quercifolia* — The Lappet

Saturnidae

1643 *Saturnia pavonia* — Emperor Moth

Drepanidae

1646 *Drepana binaria* — Oak Hook-tip
1648 *Drepana falcataria* — Pebble Hook-tip
1651 *Cilix glaucata* — Chinese Character

Thyatiridae

1652 *Thyatira batis* — Peach Blossom
1653 *Habrosyne pyritoides* — Buff Arches
1654 *Tethea ocularis* — Figure of Eighty
1655 *Tethea or* — Poplar Lutestring

Geometridae

1663 *Alsophila aescularia* — March Moth
1665 *Pseudoterpna pruniata* — Grass Emerald
1666 *Geometra papilionaria* — Large Emerald
1667 *Comibaena bajularia* — Blotched Emerald
1669 *Hemithea aestivaria* — Common Emerald
1673 *Hemistola chrysoprasaria* — Small Emerald
1682 *Timandra griseata* — Blood Vein
1688 *Scopula rubiginata* — Tawny Wave
1690 *Scopula imitaria* — Small Blood Vein
1692 *Scopula immutata* — Lesser Cream Wave

1702	*Idaea biselata*	Small Fan-footed Wave
1705	*Idaea fuscovenosa*	Dwarf Cream Wave
1708	*Idaea dimidiata*	Single-dotted Wave
1711	*Idaea trigeminata*	Treble Brown Spot
1713	*Idaea aversata*	Riband Wave
1719	*Orthonama vittata*	Oblique Carpet
1724	*Xanthorhoe spadicearia*	Red Twin-spot Carpet
1725	*Xanthorhoe ferrugata*	Dark-barred Twin-spot Carpet
1726	*Xanthorhoe quadrifasciata*	Large Twin Spot Carpet
1727	*Xanthorhoe montanata*	Silver Ground Carpet
1728	*Xanthorhoe fluctuata*	Garden Carpet
1732	*Scotopteryx chenopodiata*	Shaded Broad Bar
1738	*Epirrhoe alternata*	Common Carpet
1742	*Camptogramma bilineata*	Yellow Shell
1745	*Larentia clavaria*	The Mallow
1746	*Anticlea badiata*	Shoulder Stripe
1747	*Anticlea derivata*	The Streamer
1752	*Cosmorhoe ocellata*	Purple Bar
1757	*Eulithis mellinata*	The Spinach
1758	*Eulithis pyraliata*	Barred Straw
1759	*Ecliptopera silaceata*	Small Phoenix
1764	*Chloroclysta truncata*	Common Marbled Carpet
1765	*Cidaria fulvata*	Barred Yellow
1766	*Plemyria rubiginata*	Blue Bordered Carpet
1768	*Thera obeliscata*	Grey Pine Carpet
1771	*Thera juniperata*	Juniper Carpet
1773	*Electrophaes corylata*	Broken-barred Carpet
1776	*Colostygia pectinataria*	Green Carpet
1777	*Hydriomena furcata*	July Highflyer
1778	*Hydriomena impluviata*	May Highflyer
1781	*Horisme vitalbata*	Small Waved Umber
1794	*Euphyia unangulata*	Sharp Angled Carpet
1795	*Epirrita dilutata*	November Moth
1796	*Epirrita christyi*	Pale November Moth
1797	*Epirrita autumnata*	Autumnal Moth
1799	*Operophtera brumata*	Winter Moth
1803	*Perizoma alchemillata*	Small Rivulet
1808	*Perizoma flavofasciata*	Sandy Carpet
1809	*Perizoma didymata*	Twin Spot Carpet
1816	*Eupithecia linariata*	Toadflax Pug
1819	*Eupithecia exiguata*	Mottled Pug
1823	*Eupithecia venosata*	Netted Pug
1825	*Eupithecia centaureata*	Lime-speck Pug
1828	*Eupithecia satyrata*	Satyr Pug
1832	*Eupithecia assimilata*	Currant Pug
1834	*Eupithecia vulgata*	Common Pug
1835	*Eupithecia tripunctaria*	White-spotted Pug
1837	*Eupithecia subfuscata*	Grey Pug
1838	*Eupithecia icterata*	Tawny Speckled Pug
1839	*Eupithecia succenturiata*	Bordered Pug
1852	*Eupithecia abbreviata*	Brindled Pug
1858	*Chloroclystis v-ata*	V-Pug
1860	*Chloroclystis rectangulata*	Green Pug
1862	*Gymnoscelis rufifasciata*	Double-striped Pug
1884	*Abraxas grossulariata*	Magpie Moth
1887	*Lomaspilis marginata*	Clouded Border
1888	*Ligdia adustata*	Scorched Carpet
1894	*Semiothisa clathrata*	Latticed Heath
1897	*Semiothisa wauaria*	The V-Moth
1904	*Plagodis dolabraria*	Scorched Wing
1906	*Opisthograptis luteolata*	Brimstone Moth

1910	*Apeira syringaria*	Lilac Beauty
1911	*Ennomos autumnaria*	Large Thorn
1913	*Ennomos alniaria*	Canary-shouldered Thorn
1914	*Ennomos fuscantaria*	Dusky Thorn
1915	*Ennomos erosaria*	September Thorn
1917	*Selenia dentaria*	Early Thorn
1920	*Odontopera bidentata*	Scalloped Hazel
1921	*Crocallis elinguaria*	Scalloped Oak
1922	*Ourapteryx sambucaria*	Swallow-tailed Moth
1923	*Colotois pennaria*	Feathered Thorn
1926	*Apocheima pilosaria*	Pale Brindled Beauty
1927	*Lycia hirtaria*	Brindled Beauty
1930	*Biston strataria*	Oak Beauty
1931	*Biston betularia*	Peppered Moth
1932	*Agriopis leucophaearia*	Spring Usher
1934	*Agriopis marginaria*	Dotted Border
1935	*Erannis defoliaria*	Mottled Umber
1936	*Menophra abruptaria*	Waved Umber
1937	*Peribatodes rhomboidaria*	Willow Beauty
1941	*Alcis repandata*	Mottled Beauty
1947	*Ectropis bistortata*	The Engrailed
1954	*Bupalus piniaria*	Bordered White
1955	*Cabera pusaria*	Common White Wave
1956	*Cabera exanthemata*	Common Wave
1957	*Lomographa bimaculata*	White-pinion Spotted
1958	*Lomographa temerata*	Clouded Silver
1960	*Thera primaria*	Early Moth
1961	*Campaea margaritata*	Light Emerald
1962	*Hyleae fasciaria*	Barred Red
Sphingidae		
1976	*Sphinx ligustri*	Privet Hawk-moth
1978	*Hyloicus pinastri*	Pine Hawk-moth
1979	*Mimas tiliae*	Lime Hawk-moth
1980	*Smerinthus ocellata*	Eyed Hawk-moth
1981	*Laothoe populi*	Poplar Hawk-moth
1984	*Macroglossum stellatarum*	Humming-bird Hawk-moth
1991	*Deilephila elpenor*	Elephant Hawk-moth
1992	*Deilephila porcellus*	Small Elephant Hawk-moth
Notodontidae		
1994	*Phalera bucephala*	Buff Tip
1995	*Cerura vinula*	Puss Moth
1997	*Furcula furcula*	Sallow Kitten
1999	*Stauropus fagi*	Lobster Moth
2000	*Notodonta dromedarius*	Iron Prominent
2003	*Eligmodonta ziczac*	Pebble Prominent
2005	*Peridea anceps*	Great Prominent
2006	*Pheosia gnoma*	Lesser Swallow Prominent
2007	*Pheosia tremula*	Swallow Prominent
2008	*Ptilodon capucina*	Coxcomb Prominent
2009	*Ptilodontella cucullina*	Maple Prominent
2011	*Pterostoma palpina*	Pale Prominent
2015	*Drymonia ruficornis*	Lunar Marbled Brown
2019	*Clostera curtula*	Chocolate Tip
2020	*Diloba caeruleocephala*	Figure of Eight
Lymantriidae		
2026	*Orygia antiqua*	The Vapourer
2028	*Dasychira pudibunda*	Pale Tussock
2030	*Euproctis similis*	Yellow Tail
2031	*Leucoma salicis*	White Satin Moth
Arctiidae		
2044	*Eilema griseola*	Dingy Footman

2047	*Eilema complana*	Scarce Footman
2050	*Eilema lurideola*	Common Footman
2057	*Arctia caja*	Garden Tiger
2060	*Spilosoma lubricipeda*	White Ermine
2061	*Spilosoma luteum*	Buff Ermine
2063	*Diaphora mendica*	Muslin Moth
2064	*Phragmatobia fuliginosa*	Ruby Tiger
2069	*Tyria jacobaeae*	The Cinnabar
Nolidae		
2077	*Nola cucullatella*	Short-cloaked Moth
Noctuidae		
2082	*Euxoa nigricans*	Garden Dart
2085	*Agrotis vestigialis*	Archer's Dart
2087	*Agrotis segetum*	Turnip Moth
2089	*Agrotis exclamationis*	Heart and Dart
2091	*Agrotis ipsilon*	Dark Swordgrass
2092	*Agrotis puta*	Shuttle-shaped Dart
2098	*Axylia putris*	Flame
2102	*Ochropleura plecta*	Flame Shoulder
2105	*Rhyacia simulans*	Dotted Rustic
2107	*Noctua pronuba*	Large Yellow Underwing
2109	*Noctua comes*	Lesser Yellow Underwing
2110	*Noctua fimbriata*	Broad-bordered Yellow Underwing
2111	*Noctua janthina*	Lesser Broad-bordered Yellow Underwing
2112	*Noctua interjecta*	Least Yellow Underwing
2113	*Spaelotis ravida*	Stout Dart
2114	*Graphiphora augur*	Double Dart
2117	*Paradiarsia glareosa*	Autumnal Rustic
2118	*Lycophotia porphyrea*	True Lover's Knot
2120	*Diarsia mendica*	Ingrailed Clay
2122	*Diarsia brunnea*	Purple Clay
2123	*Diarsia rubi*	Small Square-spot
2126	*Xestia c-nigrum*	Setaceous Hebrew Character
2128	*Xestia triangulum*	Double Square-spot
2133	*Xestia sexstrigata*	Six-striped Rustic
2134	*Xestia xanthographa*	Square-spot Rustic
2136	*Naenia typica*	The Gothic
2138	*Anaplectoides prasina*	Green Arches
2139	*Cerastis rubricosa*	Red Chestnut
2145	*Discestra trifolii*	Nutmeg
2147	*Hada nana*	The Shears
2148	*Polia bombycina*	Pale Shining Brown
2154	*Mamestra brassicae*	Cabbage Moth
2155	*Melanchra persicariae*	Dot Moth
2157	*Lacanobia w-latinum*	Light Brocade
2158	*Lacanobia thalassina*	Pale-shouldered Brocade
2160	*Lacanobia oleracea*	Bright-line Brown-eye
2163	*Ceramica pisi*	Broom Moth
2164	*Hecatera bicolorata*	Broad Barred White
2166	*Hadena rivularis*	The Campion
2167	*Hadena perplexa*	Tawny Shears
2170	*Hadena compta*	Varied Coronet
2173	*Hadena bicruris*	The Lychnis
2176	*Cerapteryx graminis*	Antler Moth
2177	*Tholera cespitis*	Hedge Rustic
2178	*Tholera decimalis*	Feathered Gothic
2179	*Panolis flammea*	Pine Beauty
2182	*Orthosia cruda*	Small Quaker
2186	*Orthosia gracilis*	Powdered Quaker
2187	*Orthosia stabilis*	Common Quaker
2188	*Orthosia incerta*	Clouded Drab

2190	*Orthosia gothica*	Hebrew Character
2192	*Mythimna conigera*	Brown-line Bright-eye
2193	*Mythimna ferrago*	The Clay
2198	*Mythimna impura*	Smoky Wainscot
2199	*Mythimna pallens*	Common Wainscot
2205	*Mythimna comma*	Shoulder-striped Wainscot
2214	*Cucullia chamomillae*	Chamomile Shark
2216	*Cucullia umbratica*	The Shark
2221	*Cucullia verbasci*	The Mullein
2225	*Brachylomia viminalis*	Minor Shoulder-knot
2237	*Lithophane ornitopus lactipennis*	Grey Shoulder-knot
2240	*Lithophane leautieri hesperica*	Blair's Shoulder-knot
2243	*Xylocampa areola*	Early Grey
2245	*Allophyes oxycanthae*	Green Brindled Crescent
2248	*Dryobotodes eremita*	Brindled Green
2256	*Eupsilia transversa*	The Satellite
2258	*Conistra vaccinii*	The Chestnut
2259	*Conistra ligula*	Dark Chestnut
2262	*Agrochola circellaris*	The Brick
2263	*Agrochola lota*	Red-line Quaker
2264	*Agrochola macilenta*	Yellow-line Quaker
2265	*Agrochola helvola*	Flounced Chestnut
2266	*Agrochola litura*	Brown-spot Pinion
2267	*Agrochola lychnidis*	Beaded Chestnut
2269	*Atethmia centrago*	Centre Barred Sallow
2270	*Omphaloscelis lunosa*	Lunar Underwing
2271	*Xanthia citrago*	Orange Sallow
2272	*Xanthia aurago*	Barred Sallow
2273	*Xanthia togata*	Pink-barred Sallow
2274	*Xanthia icteritia*	The Sallow
2278	*Acronicta megacephala*	Poplar Grey
2279	*Acronicta aceris*	The Sycamore
2280	*Acronicta leporina*	The Miller
2281	*Acronicta alni*	Alder Moth
2284	*Acronicta pisi*	Grey Dagger
2290	*Simyra albovenosa*	Reed Dagger
2297	*Amphipyra pyramidea*	Copper Underwing
2299	*Amphipyra tragopogonis*	Mouse Moth
2300	*Mormo maura*	Old Lady
2301	*Dypterygia scabriuscula*	Bird's Wing
2302	*Rusina ferruginea*	Brown Rustic
2303	*Thalpophila matura*	Straw Underwing
2305	*Euplexia lucipara*	Small Angle Shades
2306	*Phlogophora meticulosa*	Angle Shades
2312	*Ipimorpha subtusa*	The Olive
2314	*Enargia ypsillon*	Dingy Shears
2316	*Cosmia affinis*	Lesser-spotted Pinion
2317	*Cosmia diffinis*	White-spotted Pinion
2318	*Cosmia trapezina*	Dunbar
2321	*Apamea monoglypha*	Dark Arches
2322	*Apamea lithoxylaea*	Light Arches
2326	*Apamea crenata*	Clouded-bordered Brindle
2327	*Apamea epomidion*	Clouded Brindle
2330	*Apamea remissa*	Dusky Brocade
2333	*Apamea anceps*	Large Nutmeg
2334	*Apamea sordens*	Rustic Shoulder-knot
2336	*Apamea ophiogramma*	Double Lobed
2337	*Oligia strigilis*	Marbled Minor
2339	*Oligia latruncula*	Tawny Marbled Minor
2340	*Oligia fasciuncula*	Middle-barred Minor
2341	*Mesoligia furuncula*	Cloaked Minor

2342	*Mesoligia literosa*	Rosy Minor
2343	*Mesapamea secalis*	Common Rustic
2345	*Photedes minima*	Small Dotted Buff
2352	*Eremobia ochroleuca*	Dusky Sallow
2353	*Luperina testacea*	Flounced Rustic
2360	*Amphipoea oculea*	Ear Moth
2361	*Hydraecia micacea*	Rosy Rustic
2364	*Gortyna flavago*	Frosted Orange
2368	*Celaena leucostigma*	The Crescent
2369	*Nonagria typhae*	Bulrush Wainscot
2375	*Rhizedra lutosa*	Large Wainscot
2377	*Arenostola phragmitidis*	Fen Wainscot
2380	*Charanyca trigrammica*	Treble Lines
2381	*Hoplodrina alsines*	Uncertain
2382	*Hoplodrina blanda*	The Rustic
2387	*Caradrina morpheus*	Mottled Rustic
2389	*Caradrina clavipalpis*	Pale Mottled Willow
2403	*Heliothis peltigera*	Bordered Straw
2418	*Earias clorana*	Cream-bordered Green Pea
2422	*Pseudoips fagana britannica*	Green Silver-lines
2434	*Diachrysia chrysitis*	Burnished Brass
2437	*Polychrysia moneta*	Golden Plusia
2441	*Autographa gamma*	Silver Y
2442	*Autographa pulchrina*	Beautiful Golden Y
2443	*Autographa jota*	Plain Golden Y
2450	*Abrostola triplasia*	The Spectacle
2452	*Catocala nupta*	Red Underwing
2466	*Lygephila pastinum*	The Blackneck
2469	*Scoliopteryx libatrix*	The Herald
2473	*Laspeyria flexula*	Beautiful Hook-tip
2474	*Rivula sericealis*	Straw Dot
2477	*Hypena proboscidalis*	The Snout
2489	*Herminia tarsipennalis*	The Fan-foot
2492	*Herminia nemoralis*	Small Fan-foot

Acknowledgements

I would like to thank John Fenn of Hockwold, Gerry Haggett of Caston, and Dave Hipperson of Norwich, for assistance with the identification of species. I also thank the staff of the Natural History Department at Norwich Castle Museum for allowing access to the collections.

References

BRADLEY, J. D. & FLETCHER, D. S. 1979 A Recorder's Log Book or Label List of British Butterflies and Moths. London: Curwen Press.

SKINNER, B. 1984 Colour Identification Guide to Moths of the British Isles. Harmondsworth: Viking.

THE MILLIPEDE *CYLINDROIULUS LONDINENSIS* IN NORFOLK—When Brade-Birks (1920, *Ann. Mag. nat. Hist.* (9) **6**, 470-477) wrote their Notes on Myriapoda 25, Preliminary Lists for Lincolnshire and Norfolk, they included *Cylindroiulus londinensis*. In the Millipedes of Norfolk (1987, *Trans. Norfolk Norwich Nat. Soc.* **27**(5), 363-369), I said that its occurrence in this county was doubtful. I am happy to announce that it has been found, in large numbers, in a wood pile at Bressingham (TM085805). This is the only record for East Anglia which seems odd as it is a large species and not easily overlooked. Its range extends to the North of England but its stronghold is around London. It was evidently breeding at Bressingham, as both adults and various sizes of immatures were present. The species was found by members of the British Myriapod Study Group on 20 April 1990 at their Annual Weekend Meeting, which was based in North Suffolk this year.

R.E. JONES, The Lynn Museum, Old Market Square, King's Lynn, PE30 1NL.

ADDITIONAL RECORDS OF *CLADONIA* (LICHENS) IN NORFOLK

S.A. Manning

9 Eversley Court, Cromer, Norfolk NR27 9HR

Introduction

With the publication of Peter Lambley's lichen flora of Norfolk (Lambley, 1988, 1989) students now have a valuable bench-mark from which to move according to their individual interests in the county's lichens.

As a supplement to his work, I move back in time and present additional records of *Cladonia* species which have accumulated from my long interest in this genus, whose members may form important features of the vegetation of heaths, dunes and even waste places. I also include notes on excluded species and doubtful records and supplementary data on habitats.

Additional records

Except where otherwise stated, all collections were made by the present author and there is supporting material in his personal herbarium. Changes in the numbers of 10 km squares from which Lambley recorded each species are shown in the form 10 + 7 and grid references of records up to and including 1960 are placed in parenthesis. HbBM—British Museum (Natural History) herbarium.
HbSAM -author's herbarium

Cladonia arbuscula: 6 + 5
53/(74) Holme-next-the-Sea, E. Dahl & M.C.F. Proctor, 1952; 52/78 Weeting, P. Harding, 1964; 63/01 Bylaugh, 1965; 63/11 Horsford Heath, 1980; 63/41 Winterton, A.J. Kerr 1965.

Cladonia cariosa: 2 + 0
53/(91) Honeypot Wood, Wendling, E.A. Ellis 1958, conf. 1990 H.J.M. Sipman (Botanical Garden & Museum, Berlin-Dahlem) HbSAM. This record pre-dates the oldest published Norfolk one (Lambley, 1989) by 23 years and is therefore the first known occurrence of the species in the county.

Cladonia cervicornis: 4 + 1
63/14 Sheringham, 1965.

Cladonia chlorophaea agg. 28 + 8
53/70,72; 52/79,88; 63/14,24; 62/(08),(09)

Cladonia ciliata var. **tenuis** 7 + 4
53/63; 63/01,14; 62/(09)

Cladonia coccifera 9 + 2
53/72; 63/01

Cladonia coniocraea 42 + 2
53/70; 62/(08)

Cladonia crispata var. **cetrariiformis** 6 + 2
52/98 Bridgham Heath, 1970; 63/22 Bryants Heath, F. Rose 1969 HbBM.

Cladonia digitata 5 + 1
63/11 Felthorpe woods, 1970

Cladonia fimbriata 32 + 5
53/74; 63/20,24; 62/(07),(08)

Cladonia floerkeana 11 + 3
52/98; 63/14; 62/(09)

Cladonia foliacea 9 + 2
53/63,74

Cladonia furcata 11 + 8
53/63,72; 52/(78),79,88; 63/(11),24; 62/(09)

Cladonia glauca 4 + 5
53/62 Wolferton, 1972; Roydon Common, E.A. Ellis 1953; 53/(84) Scolt Head Island, E.A. Ellis 1936, HbBM & HbSAM; 52/98 Bridgham Heath, 1970; 63/01 Bylaugh 1965; 63/11 Felthorpe, 1979; Horsford, 1948-51

Cladonia gracilis 5 + 5
53/(90) Saham Toney, Miss E.R. Noble 1939; 52/(89) Tottington, Miss E.R. Noble, 1938; 63/(12) Buxton Heath, E.A. Ellis, 1939; 63/14 Sheringham, 1965; 62/(08) Old Buckenham Hall, 1949.

Cladonia humilis 2 + 8
53/63 Snettisham, 1971; 53/72 Great Massingham, 1971; 53/74 Holme next the Sea, 1971; 63/14 Sheringham, 1965; Beeston Regis, 1948; 63/(21) Spixworth, 1947; 63/24 Cromer, 1982; 63/(30) Wheatfen, M.J.D. Cockle, 1937; 62/(08) Old Buckenham Hall, 1949.

Cladonia macilenta 25 + 4
52/(89); 63/01,20; 62/(09)

Cladonia ochrochlora 2 + 2
63/(30) Wheatfen, 1942; 62/(08) Old Buckenhamn Hall, 1949-50

Cladonia pocillum 6 + 1
53/74 Holme-next-the-Sea, 1971

Cladonia polydactyla 3 + 2
63/11 Felthorpe, 1970; 63/12 Marsham Heath, 1979

Cladonia portentosa 11 + 1
63/14

Cladonia pyxidata 2 + 1
53/74 Holme-next-the-Sea, 1971

Cladonia ramulosa 6 + 7
53/63 Snettisham, 1971; 53/72 Great Massingham, 1971; 52/79 by Swaffham Gap, 1970; 63/11 Horsford-Felthorpe, 1936-79; 63/24 Cromer, 1982; 62/(08) Old Buckenham Hall, 1950; 62/(09) Old Buckenham Hall, 1949-50

Cladonia rangiformis 8 + 6
53/63,74; 52/79,88; 63/24; 62/(08)

Cladonia scabriuscula 3 + 6
63/(11) Horsford-Felthorpe, 1937-48; 63/(14) Beeston Regis, 1948; 63/20 Mousehold Heath, 1984; 63/24 Cromer, 1982; 62/(08) Old Buckenham Hall, 1949-50; 62/(09) Old Buckenham Warren, 1949

Cladonia squamosa 7 + 2
63/01; 62/(09)

Cladonia subulata 3 + 10
53/(62) Wolferton, E.L. Swann, 1958; 53/72 Great Massingham, 1971; 53/(91) Bilney, Miss E.R. Noble 1960; 52/88 Croxton, 1969; 63/01 Bylaugh, 1965; 63/(11) Horsford-Felthorpe, 1936-48; Ringland Hills, 1949; 63/(14) Beeston Regis, 1948; 63/(30) Wheatfen, 1942; 62/(07) Little Fen, South Lopham, E.A. Ellis 1953; 62/(09) Old Buckenham Hall, 1949-50

Cladonia uncialis ssp. **biuncialis** 7 + 2
52/(89); 63/14

Excluded species and doubtful records

Cladonia caespiticia: I support Lambley's view that the Blakeney Point record is doubtful. Certainly the Census Catalogue (Watson, 1953) entry for East Norfolk was based on incorrectly determined material.

Cladonia mitis: Lambley is correct in excluding this species from the Norfolk list. My records for 53/(62) and 63(11) (Manning, 1960) were errors. According to annotations by W. Watson in a manuscript catalogue (Manning 1938), A.L. Smith named a Blakeney specimen as *Cladonia mitis*. However, despite their remark that this unconfirmed report could be correct, Brown and Brown (1968) did not find the species during their three-year study at Blakeney Point.

Cladonia pleurota: Lambley's verdict "status uncertain" is most apt, for Norfolk specimens previously referred to this species by me belong to *Cladonia coccifera* as now understood. The species should be deleted from the Norfolk list.

Cladonia stellaris: The old records for Scolt Head and Blakeney Point are, as Lambley suggests, almost certainly errors for the reasons given by Manning (1960) and Brown & Brown (1968)

Cladonia subcervicornis: Rightly excluded from Lambley's Norfolk list. The Census

Catalogue (Watson, 1953) entry for East Norfolk was an error based on incorrectly determined material.

Cladonia habitats in Norfolk

Inevitably sites and habitats are listed according to an author's own experience, but as this widens over time and space the lists become longer and more varied. Thus, while it is true that, as Peter Lambley asserts, most Norfolk records of this "reindeer moss" are from dunes, *Cladonia arbuscula* also grows on odd bits of heathy ground and at the sides of forest rides. Similarly the little cup-lichen *Cladonia humilis* is not confined to dunes but may turn up on other light soils both at the coast and inland.

The important thing is that students of lichens (and not only lichens) should always be ready to attempt to answer for themselves the two key questions posed by that great Kew botanist Sir Edward Salisbury: "What have we here? What is happening here?"

In this way, one discovered, for example, lichens growing on decaying thatch at Old Buckenham, the species including *Cladonia chlorophaea*, *C. coniocraea*, *C. macilenta*, *C. ramulosa* and *C. subulata*.

Finally, a plea to those caring for nature reserves, country parks, woods and commons: please don't be too clean and tidy but leave well alone. Lichens (and indeed many other organisms) need decaying logs, undisturbed ground and tree trunks, especially in places like Norfolk where, as Peter Lambley's excellent Lichen Flora makes plain, so many species have vanished.

Acknowledgements

I would like to thank Dr Martin Ellis for his kind advice, which stimulated me to produce this paper.

References

BROWN, D.H. & BROWN, R.M. 1968 The lichens of Blakeney Point, Norfolk. *Lichenologist* **4**, 1-15

LAMBLEY, P.W. 1988 The Lichen Flora of Norfolk. *Trans. Norfolk Norwich Nat. Soc.* **28**(1), 13-32

LAMBLEY, P.W. 1989 The Lichen Flora of Norfolk—Systematic list. *Trans. Norfolk Norwich Nat. Soc.* **28**(3), 183-220

MANNING, S.A. 1938 *Records of lichens found in the county of Norfolk*. Manuscript heavily annotated by W. Watson. In Manning personal collection.

MANNING, S.A. 1960 New, rare and critical Norfolk lichens—1. *Trans. Norfolk Norwich Nat. Soc.* **19**, 65-68

WATSON, W. 1953 *Census catalogue of British lichens*. London: Cambridge University Press

1989 WEATHER SUMMARY

N.W.K. Brooks

79 The Street, Old Costessey, Norfolk

January—So benign and persistently mild was the month that it was difficult not to become lulled into a conviction that spring had already arrived. Constant high pressure to the south fed a nearly continuous supply of warm and dry south west and southerly winds across the county, with most of Norfolk recording little more than half the normal monthly rainfall, making it the driest January since 1973. For the first time for many years there has been a successive December and January devoid of snow.

February - The mildest since 1961, (although in a few areas 1974 was even milder). The mean temperature of 5.6°C was actually higher than the average for March! Day maxima were particularly high, with a very high early February reading of 15.0°C on the 6th, (the highest February temperature since 1976). Rainfall was rather below average throughout the county. Very slight snow fell on two days. An exceptionally deep depression passed near to East Anglia on the 25th, and caused the barometer to fall to 950 millibars (28.05 inches), which is the lowest ever recorded in Norfolk, (although in January 1886 it fell to near that figure at 28.08 inches).

March - Another very mild month, (the mildest since 1981), with daytime temperatures befitting April rather than March. The warmth at times rivalled early summer, and the magnificent 19.4°C reached on the 30th was the highest March temperature recorded since 20.4°C was noted in mid-March 1972. The effect of the premature warmth was very apparent, with many plants and trees exhibiting growth about three weeks ahead of normal. Rainfall was above average throughout the county. The most dramatic event of the month was the quite exceptional display of the *aurora borealis* (Northern Lights), observed during the night of the 13th—14th. The display commenced around 22.00 hrs with a pronounced pale white glow, (as if sunrise was imminent), on the northern horizon. At 00.30 hrs on the 14th occasional rays of light were extending from the north to an elevation of about 60°. Between 01.00—01.30 hrs the display intensified with "curtains" or "hanging drapery" forms of the aurora, shimmering and extending at times to 90°. To the north-north east rayed patches of light were visible. The colour of the aurora throughout was pale yellow, sometimes very pale greem. Its intensity was comparable, and sometimes exceeding, moonlit cirrus cloud. It is extremely rare at our latitudes to observe an aurora display extending virtually overhead.

April - At long last the sequence of warm months come to an end, and the month had a mean temperature as much as 1.1°C below that of March. It was the wettest April since 1981, and the coldness of the month was emphasized by snow, albeit slight, being observed on five days. Funnel clouds were seen along the eastern sector of the Norfolk/Suffolk border on the 13th, and a waterspout was observed on the river Yare at the Buckenham Marshes on the same date.

May - A superb month with temperatures worthy of high summer. It was the warmest May since 1947 and the sunniest since before 1925. Rainfall was very deficient, with the only comparably dry Mays since 1841 being 1960 and 1936. Maxima of 21°C or over were recorded on twelve days, and the maximum of 28.2°C on the 24th was notable.

June - A variable month with a mean temperature close to normal. Although mainly dry until the final week heavy thunderstorms on the 27th and 30th yielded rainfall totals of over 30mm on both dates, resulting in much of the county having double the normal rainfall. In a small area just to the west of Norwich it was very wet with 260% of average rainfall recorded.

July - The sunniest since 1976 and the warmest for six years. Maxima of 21°C were reached or exceeded on twenty two days and 25°C was recorded daily from the 19th—26th inclusive. On the 22nd 29.4°C was reached, the year's hottest day.

Rainfall was very variable due to heavy thunderstorms on the 8th and 29th. Much of the county was quite dry however, but the thunderstorm on the 8th produced some notable falls of 54.7mm at Bracon Ash, and 53.8 mm at Colney. A small tornado, described as resembling an 'upside down ice-cream cone' was observed at Beetley near Dereham on the 21st.

August - Exceptionally sunny, dry, and warm, the ration of sunshine being the most generous in August since the memorable summer of 1976. A complete absence of thunderstorms allowed the county's rainfall distribution to be fairly uniform, although some localized heavy rain on the 26th allowed a few areas to be particularly wet. The rainfall total of 48.5 mm at Felmingham on that date is noteworthy.

September - A continuation of sunny conditions until the final week, when cloudy skies and falling temperatures heralded the approach of autumn. However it shared with 1988 the distinction of being the warmest September in Norfolk since 1961. Rainfall was exceptionally variable with many southern parts of the county experiencing a very dry month, while in many northern localities it was rather wet. The 16th was a very wet day in much of North Norfolk, with 24 hours rainfall totals of 38.4 mm at North Creake, 37.0 mm at Warham, 36.0 mm at Holme, and 35.2 mm at Langham.

October - The warmest since 1969, with temperatures actually tending to rise as the month progressed. It was dry almost everywhere, and air frost was escaped—unusual for October.

November - The sunniest since 1973, and although much of the month was mild, it became cold and frosty during the final week when clear skies allowed the month's frost frequency to be excessive, there being ten air frosts and nineteen ground frosts.

December - The seventh December in succession to be milder than average, although there was a frosty spell early in the month. The 1st with a maximum of 2.3°C, screen minimum of -5.9°C,and ground minimum of -8.7°C was the coldest night and day of the year. Norfolk was out of step with much of the United Kingdom in that it was a wet month at almost all stations, indeed some localities experienced their wettest December for ten years. A very destructive tornado swept through Long Stratton on the 14th, and another, less wilful tornado occurred at Croxton, near Thetford on the 21st.

The Year—With a mean temperature of 10.5°C 1989 was one of the warmest years in Norfolk since reliable records began in 1659. However 1938 had an almost identical mean temperature, and 1945 and 1959 were only 0.1°C cooler. As a comparison, the 'hot summer' years of 1975 and 1976 produced annual means of 10.2°C and 10.3°C respectively. The year was particularly noteworthy for sustained warmth, only April being significantly colder than normal. Throughout most of the year sunshine amounts were excessive, and most months were dry, although Norfolk fared better than most of England as there was usually just enough rainfall to prevent the ground from becoming excessively parched. Although very slight snow was observed on nine days, there was not a single occasion when snow lay in 1989—a very rare occurrence.

1989 WEATHER

	MEAN TEMPERATURE °C		NO. OF AIR AND GROUND FROSTS		SUNSHINE HOURS	
	1989	Avg.	1989	Avg.	1989	Avg.
Jan.	5.3	3.5	11/16	11/19	65.1	51.2
Feb.	5.6	3.2	8/19	12/18	94.8	66.8
March	7.7	5.3	6/13	7/17	112.4	100.6
April	6.6	7.3	4/14	4/14	116.0	154.2
May	12.8	10.9	1/6	1/6	296.5	193.5
June	14.3	14.0	0/2	rare	254.1	202.6
July	17.7	16.0	—	very rare	277.0	193.9
August	16.9	16.2	—	very rare	234.1	186.7
Sept.	15.1	13.9	0/0	rare/1	126.1	149.8
Oct.	12.1	10.4	0/3	1/6	87.8	109.1
Nov.	6.2	6.5	10/19	5/12	103.4	67.6
Dec.	4.9	4.2	11/14	9/17	34.6	50.5
Year	10.5	9.3	51/106	49/109	1801.9	1526.5

	RAINFALL mm		DAYS WITH SNOW/HAIL		DAYS WITH THUNDER	
	Costessey	Taverham				
	1989	Avg.	1989	Avg.	1989	Avg.
Jan.	27.5	58.4	0/0	5/1	0	rare
Feb.	36.7	45.0	2/0	4/1	0	rare
March	53.1	42.7	1/0	3/1	1	rare
April	75.9	39.9	5/2	1/1	2	1
May	10.4	41.7	0/2	rare	3	2
June	124.8	43.2	0/1	very rare/rare	5	3
July	52.9	57.9	—/0	—/rare	3	3
August	24.4	54.9	—/0	—/rare	0	3
Sept.	21.2	53.6	—/0	—/rare	1	2
Oct.	44.7	62.5	0/0	rare	0	1
Nov.	39.7	71.1	0/0	2/1	1	rare
Dec.	100.5	57.7	1/0	3/1	1	rare
Year	611.8	628.6	9/5	18/6	17	15

Averages quoted above are for 46 years to 1984 for rainfall, otherwise for 17 years to 1984.

NOTES FOR AUTHORS

The Transactions are published each year in the spring. Manuscripts should be with the editor by 1 December of the previous year.

Authors are requested to write to the editor for a copy of *Instructions for Authors* **before** writing a paper.

This issue of the *Transactions* may be used as a general guide to content and format, but it is advisable to consult the editor before preparing final text, figures etc. Failure to do this might result in delayed publication.

The editor will be pleased to discuss proposals for papers by any member, and will help novice authors with the production of material.

All communications, including manuscripts for publication should be sent to: **The Editor, Norfolk and Norwich Naturalists' Society, Castle Museum, Norwich, NR1 3JU.**

NORFOLK & NORWICH NATURALISTS' SOCIETY

Patron: Her Majesty the Queen

The County's senior natural history society. It has for its principal objectives the practical study of natural science, the conservation of wild life, the publication of papers on natural history, especially those related to the county of Norfolk, arranging lectures and meetings and the promotion of active fieldwork. Specialist Groups cover most aspects of the county's flora and fauna.

Annual Subscription Rates:
Junior £3.00
Ordinary £8.00
Family £10.00
Affiliation £15.00

Publications:
May: Transactions
August: Bird & Mammal Report
Quarterly newsletter: 'Natterjack'

Secretary:
A. L. Bull
Hillcrest
East Tuddenham
Dereham
Norwich NR20 3JJ.

Membership Secretary:
C. Dack
12 Shipdham Road
Toftwood
Dereham
Norfolk NR19 1JJ

CONTENTS

		Page
Presidential address — In search of wildlife	*M.A. Brewster*	329
The end of an era	*E.T. Daniels*	336
Ditch-flora of the Halvergate Marshes	*N.D. Burgess & C.E. Evans*	341
Plant notes 1989	*G. Beckett & A.L. Bull*	350
Trocheta bykowskii — a leech new to East Anglia	*A.G. Irwin*	355
Tabanus miki (Diptera: Tabanidae) — a rare horsefly in Norfolk	*K.C. Durrant*	356
The Dragonflies of Norfolk	*P.J. Milford & A.G. Irwin*	357
Salt water penetration into the Upper Bure	*K.C. Clarke*	381
Dolichovespula media — a social wasp new to East Anglia	*A.G. Irwin*	390
Seven years of moth records from Scole — from 1981-1987	*M.R. Hall*	391
The millipede *Cylindroiulus londinensis* in Norfolk	*R.E. Jones*	401
Additional records of *Cladonia* (lichens) in Norfolk	*S.A. Manning*	402
1989 Weather summary	*N.W.K. Brooks*	405

ISSN 0375 7226 *Printed by Witley Press Ltd., Hunstanton* £3.00

Norfolk Bird & Mammal Report 1989

BRITISH MUSEUM
(NATURAL HISTORY)
- 2 AUG 1990
ESTABLISHED
GENERAL LIBRARY

Norfolk Bird Report — 1989

Editor: MICHAEL J. SEAGO
County Recorders: P. R. ALLARD, D. A. DORLING, P. J. HEATH & P. D. KIRBY
Editorial Assistants: M. S. CAVANAGH, P. R. CLARKE, G. E. DUNMORE, M. FISZER, A. HALE, J. B. KEMP, K. B. SHEPHERD & A. M. STODDART

Editorial	409
Red-breasted Nuthatch — a new British Bird	412
Pink-footed Goose movements & distribution	414
Yellow-browed Warblers in Norfolk	420
Yellow-browed Warbler of the race *humei*	424
Wildfowl Counts	425
Birds of Estuary Enquiry	426
Pacific Golden Plover — new to Norfolk	429
Barn Owls of north Norfolk	430
Indigo Bunting — an addition to the county list	431
Woodlarks in Breckland	433
Yellow-browed Bunting — first for Britain	436
A Knot catch to remember	437
Ringing Report	439
Classified Notes	445
Contributors, Photographers & Artists	479

Norfolk Mammal Report — 1989

Editor: REX HANCY

Editorial/Classified Notes	480
Contributors	482
Mink in East Anglia	483
Rat and Mouse Infestations	490
Bat Review	496

Published by THE NORFOLK & NORWICH NATURALISTS SOCIETY, Castle Museum, Norwich NR1 3JU (*Transactions* Volume 28 Part 6 August 1990) in conjunction with NORFOLK ORNITHOLOGISTS ASSOCIATION, Aslack Way, Holme-next-Sea, Hunstanton PE36 6LP. ISSN 0375 7226.
Back numbers are available from Mrs M. Dorling, 6 New Road, Hethersett NR9 3HH.

Price £3.00

NORFOLK BIRD REPORT 1989

Editorial

The Council of the Norfolk & Norwich Naturalists Society, in conjunction with Norfolk Ornithologists Association, is pleased to present the annual report on the birds of Norfolk.

Review of the Year:

January was mild as in 1988, but large congregations of wildfowl frequented the county, notably 13,500 Pink-footed Geese in the north-west and over 12,000 Brent Geese along the north coast. Single Black Brants concealed themselves in the Brent flocks at Cley and Lynn Point. The Norfolk section of the Ouse Washes held over 2,000 Bewick's Swans and 500 Whooper Swans while East Norfolk contained a peak of 370 Bean Geese on the 5th together with 310 White-fronted Geese. Large numbers of Lapwing remained to overwinter as they did again in the mild 1989/90 winter. A few Waxwings were observed and rarities included a long-staying Arctic Redpoll and a Ferruginous Duck both on the outskirts of Norwich together with an American Wigeon at Welney.

February continued mostly mild with a colder spell towards the end of the month. Berney/Halvergate area held over 600 Bewick's Swans while up to 95 Long-tailed Ducks were off Hunstanton/Holme. Only a few Smew were recorded in this mild period, but a Rough-legged Buzzard wintered on Massingham Heath and 700 Twites were at Brancaster.

March was unsettled, but warm towards its close when many summer migrants began to appear. Migrant Black-tailed Godwits were very evident with over 1,000 at Welney and 600 at Ousemouth. A wintering Iceland Gull at Yarmouth remained until the 19th. Unusual were a Richard's Pipit at Gillingham, wintering Black-bellied Dipper at Lyng until the 27th and Green-winged Teal at Welney.

An exceptionally cold start to **April** slowed down any early large-scale movements of migrants. A heavy Ring Ouzel passage developed later in the month with other species of note being 2 Hoopoes, a Richard's Pipit and the second county record of Rock Thrush — found at Waxham on 30th.

May was mostly dry and hot and produced the expected movements of Black Terns, Temminck's Stints and Dotterels along with more exotic delights such as several Broad-billed Sandpipers — mostly at Breydon, Pectoral Sandpiper at Holkham, a much appreciated Semi-palmated Sandpiper at Cley and Little Egret, Night Heron and Whiskered Tern all at Welney. Passerines included a singing Icterine Warbler at Cromer, Subalpine Warbler at Weybourne, Ortolan Bunting at Horsey, Red-throated Pipit at Blakeney Point, Thrush Nightingale at Walsey Hills, Cley for three days, but only one Bluethroat. There were also three sightings of female Red-footed Falcons.

A very hot **June** had unsettled spells at either end of the month. Oddities included Dipper, Purple Heron, Long-billed Dowitcher, Red-footed Falcon and the beginning of large numbers of Quail sightings. Both Marsh and Montagu's Harriers enjoyed a good breeding season while in the Norfolk Brecks 135 pairs of Nightjars were found, although for the first time no Red-backed Shrikes were proved to breed. Cormorants bred in the county for the first time in 70 years. Large increases in predators during recent years (notably Foxes and Corvids) have caused serious problems, especially to vulnerable colonial nesting birds. Some of the North coast breeding results for 1989 are a catalogue of disasters. Urgent control measures are required to ensure the safety of the tern and wader breeding sites. These species have already suffered severely over the years from increasing human pressure on beaches, loss of habitat and pollution.

The hottest **July** since 1976 produced the first Pacific Golden Plover for the county at Holme/Thornham, a Broad-billed Sandpiper at Breydon, Hoopoe at Weybourne and an obliging and long-staying singing River Warbler in the west of the county.

August was warm and dry although a poor month for passerines with no substantial falls. The sea began producing its usual quota of Sooty Shearwaters, Sabine's Gulls and Long-tailed Skuas while the 27th saw a huge passage of 1,200 Manx Shearwaters off Cley and 2,000 Gannets off Blakeney Point. A Little Egret frequented Ousemouth for two days and several Pectoral Sandpipers were identified. In contrast to 1988 only small numbers of Curlew Sandpipers appeared.

A warm beginning to **September**, but more unsettled later. A spell of easterlies in the first half of the month produced a varied fall of passerines including impressive numbers of Whinchats, Redstarts, Pied Flycatchers along with Wrynecks, Red-backed Shrikes and a few Red-breasted Flycatchers, Icterine and Barred Warblers. More exotic species were also involved notably Pied Wheatear at Winterton 13th/14th, Siberian Stonechat, Eastern race of Redstart and Bonelli's Warbler at Wells and Little Bunting at Yarmouth. A strong sea passage on 9th produced lots of skuas and shearwaters and also record numbers of Leach's Petrels. More Puffins than normal were recorded. The month also contained a Hoopoe at West Runton, Little Egret at Welney and female Red-footed Falcon at Waxham.

Dry and clear conditions prevailed early in **October**, but it became wetter and windier from mid-month. Exceptional numbers of both Black-throated and Great Northern Divers appeared off the coast and grebe numbers built up in Holkham Bay. Scrutiny of returning Brent Geese showed a complete breeding failure. Passerines in the month included Richard's Pipit, Yellow-browed Warblers, 4 Pallas's Warblers, Little Bunting, Red-breasted Flycatchers and a late Barred Warbler at Holkham on 26th. An influx of Water Pipits occurred especially at Cley. Bird of the month and probably the year was a most unexpected Red-breasted Nuthatch — the first for Britain. Frequenting Holkham pines, it was generally frustratingly difficult to observe as it roamed through the tree-tops in company with tit flocks.

Although cold towards its close, **November** was mostly dry, calm and mild. A quiet month birdwise, but a few Asiatic rarities were seen, notably Dusky Warbler on Blakeney Point, Pallas's Warbler at Waxham and a late Yellow-browed Warbler at Winterton resembling the race *humei*. A late Hoopoe was at Taverham and as usual small numbers of Little Auks hurtled offshore during northerly blows.

Strong winds and generally unsettled weather with heavy rain occurred in **December**. Wildfowl numbers built up to over 20,000 Pink-footed Geese in north-west Norfolk and

over 3,000 Bewick's Swans at Welney after a good breeding season. A late Spoonbill roamed the coast and an American Wigeon appeared at Welney. A small Waxwing influx brought the year to a close (Summary by JBK).

Recording: Records should be submitted to Michael J. Seago, 33 Acacia Road, Thorpe St. Andrew, Norwich NR7 0PP *by the end of January*. It is regretted that some observers are still failing to comply with this deadline which is essential to meet printing schedules. All observations should be prepared in the order followed by the 'British Birds' *List of Birds of the Western Palearctic*. It will be appreciated that notes submitted in diary form cannot be considered. In order to minimise the work involved records will not normally be acknowledged, but names of all contributors will be published.

Records of national rarities considered by 'British Birds Rarities Committee' need to be submitted to the Editor with full details *as soon as possible after observation* and not left until the year-end. There are a number of omissions in the 1989 Classified Notes of national rarities as decisions are still awaited. A full list of semi-rarity species and subspecies for consideration by the County Records Committee appears in the Editorial section of the 1988 Report.

Acknowledgements: Thanks are due to the following artists and photographers: N. Arlott, N. Borrow, D. Bryant, R. Chittenden, D. M. Cottridge, C. Donner, E. A. Fisher, A. Greensmith, A. L. Howes, B. W. Jarvis, R. Jones, J. B. Kemp, C. R. Knights, C. Lansdell, J. R. McCallum, R. Millington, R. Powley, M. S. Read, the late R. A. Richardson, J. P. Smith and A. M. Stoddart. Details appear on page 479.

Thanks are also due to The Bird Information Service, Cley Bird Club, Nar Valley Ornithological Society, National Trust, Nature Conservancy Council, Norfolk Naturalists Trust, Norfolk Ornithologists Association, Rare Bird Photographic Library (catalogues available from Robin Chittenden, 65 Sandringham Road, Norwich NR2 3RZ), RSPB, Wildfowl & Wetlands Trust, G. E. Dunmore (for liaising with 'British Birds' Rarities Committee and acting as Secretary/Chairman of the local Records Committee), Mrs M. Dorling, Mrs S. F. Seago, and all other contributors.

Red-breasted Nuthatch in Norfolk — a New British Bird

A small Nuthatch tentatively identified as a Corsican and showing a black crown and white supercilium was reported by Mr. and Mrs. R. Aley from the west end of Holkham Meals on the evening of 13th October 1989. It was feeding on a grassy path 20 feet ahead of the highly surprised observers. It quickly flew into an adjacent pine and then away through the trees.

At 8 a.m. the following morning only a handful of birders was present and nobody had encountered the bird; in fact some were already leaving! After an hour a strange call was heard from the tops of pines at the so-called 'crossroads' near the Royal Summer-House. It was a fairly quiet nasal trumpet-like call noted as '*neh, neh, neh, neh*'. Paul Varney commented to the four people present that Red-breasted Nuthatch (which has a similar head pattern to Corsican) is described in the National Geographic Society *Field Guide* as having a call 'like a toy tin horn'. This fitted the call fairly accurately. The bird was not seen, however, and the calling ceased. A short while later Peter Hayman heard the call and thought he saw the bird in flight, thus initiating a detailed search through a nearby tit flock. At 9.40 a.m. the observers were near the summer-house when a bird appeared on a pine trunk 20 yards away. It displayed a strikingly white supercilium with contrasting black eyestripe and complete black crown and nape. Upperparts were typical Nuthatch blue-grey and underparts rusty orange-brown. This combination of plumage feathers and the bird's small size confirmed its identity as a Red-breasted Nuthatch *Sitta canadensis*, a first for Britain and Ireland.

Peter Hayman and Allan Lewis both obtained brief views. Although the bird had been in view for less than a minute all were in agreement concerning identification. Despite intensive searching by others it could not be found in the immediate area of the first sighting. It was then relocated by call ten minutes later about 400 yards away.

The bird continued to be extremely elusive; some observers had a three-hour wait before it showed again. Rob Morris then arrived equipped with a tape of the species calling. When this was played the bird responded immediately, calling back and flying out of the canopy to alight in elder bushes only fifteen feet ahead and giving breathtaking views. It then performed excellently in the vicinity of the main path for a quarter of an hour before returning to the pine tops where it was difficult to see for the remainder of the day. It was feeding, clinging to the undersides of pine cones and also investigating the main track itself.

The small size of the bird was especially apparent in flight when it was judged to be about the size of a Blue Tit. The pure black crown (with no grey tones), the underpart colour intensity (compared with skins) and the response to tape are suggestive of an adult male.

And so to the bird: a charming highly active little Nuthatch displaying very sharp plumage features and an extremely distinctive call. It is very small and very mobile and Holkham Meals is extremely large. Normally it was best searched for around the summer-house and often in association with a tit flock. Once the Tits were located ears strained for the usually quiet but distinctive high-pitched call. But catching the call offered no guarantee of seeing the bird: it normally travelled with a sociable band of Tits and Goldcrests. On many occasions a group of observers would be enjoying views of the Nuthatch while others were finding Marsh, Coal and Long-Tailed Tits, Goldcrests and even Chiffchaffs and a Lesser Spotted Woodpecker.

Then it was gone! Occasionally the Tit flock was located but not a sound from the Nuthatch, yet casually raised binoculars could focus immediately on the elusive prize — before it again vanished.

It seemed to be a creature of varying habits. Although often roving with the tit flock it occasionally lingered in a favoured spot. On fine days it would feed along the sunny edge of the pines steadily moving with the tits, but generally remaining in view for some moments. It often behaved like a typical Nuthatch moving up and down trunks and along branches of large pines. Pines were generally favoured although in its first days it was found in track-side sycamores and even in small elder bushes. Less typically it fed in exposed sprays of pine needles in both large trees and rather small ones, delicately picking at the base of the needles.

Throughout its stay the Nuthatch showed a definite variation in its calls. The most typical was a nasal '*beep, beep*' usually uttered in flight or when agitated. Another shorter, fainter, version of this call was often heard when the bird was feeding with the Tit flock. From time to time the calls merged into a rapid series of short musical notes rising in pitch towards the end.

After the news was announced on Birdline Information Service an estimated 2,000 birders assembled for the grandstand viewing on Sunday 15th October. The quarry initially wandered widely being first located only just short of the far western end of the pines. Most viewing has been in the area of the summer-house (where it has come to drink) and the nearby crossroads, but many have stumbled across it well to the east of Meals House. One fortunate observer saw it as he stepped out of his car in Lady Anne's Drive! Another couple, on 15th October, having seen it near the summer-house decided to visit the Dell at the Wells end and stumbled across the bird again there. For the remainder of the year this highly unlikely New World vagrant continued to either delight or frustrate an endless procession of birders.

The Red-breasted Nuthatch is plentiful in the evergreen forests of North America. In most winters part of the population migrates east and south depending on the conifer seed crop. The species has been seen to fly 60 miles offshore in the Gulf of St. Lawrence. Numbers of Red-breasted Nuthatches passing through Cape May Bird Observatory this September were exceptionally high with a peak day-count of 120 on 30th September which was ten times higher than recent autumn maxima. The species, given a very low trans-Atlantic vagrancy potential, is at least as surprising a find as previous British records of Varied Thrush or Golden-winged Warbler.

If accepted this will be the second record of Red-breasted Nuthatch for the Western Palearctic, the first being of an adult male on the Western Islands (Iceland) on 21st May 1970.

This summary has been compiled from the extensive accounts kindly provided by A. I. Bloomfield, D. Hatton, D. Holman, and P. Varney. Acknowledgements are also due to P. Colston, A. Desrochers, S. Whitehouse; the finders Mr. & Mrs. R. Aley for additional information; and the anonymous observer who provided the Nuthatch with ample drinking water.

Pink-footed Goose Movements and Distribution

M. J. Seago

The Pink-footed Geese wintering in Britain represent the whole of the population breeding in Iceland and East Greenland. Another population numbering some 30,000 birds breeds in Svalbard (Spitsbergen), migrates through Norway to Denmark where the birds spend the autumn and spring, and winters in Holland and Belgium. In Britain the bulk of the population winters in Scotland with substantial numbers in Lancashire and in Norfolk. Those wintering in the latter county represent the most southerly assembly in the country.

Most British pink-feet breed in Iceland. There must have been an enormous expansion in numbers for the population to have changed so markedly in recent years. Many nest on rock-fall slopes in deep gorges and take their offspring to oases in the bleak lava desert. Others including those at the major Thjosarver site — where large numbers both nest and rear young in islands of vegetation — are often far from suitable cliffs. Both on a local and on a regional scale Pink-feet exhibit major shifts in distribution and they are among the most wary and intelligent of geese. This article contains details of the principal haunts of Pink-feet in Norfolk and the adjoining Fenland areas since their first documented appearances.

Holkham fresh-marshes: The first Norfolk specimen, shot at Holkham, was identified in 1841 'since which time this goose has proved to be by far the most common species frequenting Holkham Marshes'. This situation continued for at least a century, the skeins roosting on Stiffkey High Sands. A peak of between 5,000 and 8,000 was attained in the 1930s. However, following the establishment of an anti-aircraft firing range at Stiffkey the numbers decreased rapidly after 1938. War-time ploughing of the fresh-marshes followed and very few geese appeared after 1941.

Dr. B. B. Riviere's *History of the Birds of Norfolk* (1930) records the scene: 'The first flocks begin coming in during the latter half of September, the earliest date being the 10th. The main body has usually arrived by the end of October. Throughout the winter ... the numbers run into many thousands. The return journey to northern breeding grounds takes place in March. When they can do so undisturbed and particularly early in the season, Pink-feet will feed upon stubbles and new leys at some distance inland, but for many years

Holkham Marshes — where they are never disturbed — have been the favourite feeding ground. There are few more wonderful sights or sounds than their arrival from the sea at dawn or their return at dusk. Here, lying up before daylight behind the range of sand-hills, generations of Norfolk gunners have shot at them as they pass over and instinctively as they cross the danger zone the flocks lift high in the air. But from time to time in wild or foggy weather the gunners reap their reward'.

The late Sir Peter Scott's *Morning Flight* describes a 'pilgrimage to Mecca' when he first visited north Norfolk. The volume includes a painting of skein upon skein of Pink-feet over Holkham fresh-marsh against a superb sunset. The original — on display in Norwich Castle Museum in 1989 — formed part of an exhibition of the great artist's work soon after his death.

Pink-feet remained almost absent from Holkham until the 1976/7 winter when 250 made a brief appearance in December. The two succeeding winters provided a similar pattern, but during 1980/1 regular wintering began. Following controlled flooding of part of the grazing marshes from late 1986 this National Nature Reserve has again become more attractive to wildfowl. In the 1989/90 winter a post-war peak of 4,620 Pink-feet was attained. Despite the nearness of Scolt Head, the Holkham contingent has remained attached to an area off Lodge and Warham Marshes and on Stiffkey High Sands as a night-time roost thus continuing the habits of the pre-war battalions.

Peak winter counts at Holkham since 1980/81

1980/81	206	1983/4	1,500
1981/2	90	1984/5	1,500
1982/3	300		

More recent counts appear on page 419

Lower Bure and Halvergate Levels: Pink-feet began wintering in south-east Norfolk during the 1913/4 winter when 30 to 40 were using the marshes to the west of Breydon. It was about this time that Scroby Sands off Yarmouth began remaining high and dry at high tides, thus offering a safe roost. Numbers increased annually and 1,500 were present in January 1937. The impressive skeins passing over the town of Yarmouth as the birds came in from sea in early morning and returned at night became an expected winter feature. The birds normally favoured the marshes adjoining the lower Bure, although Halvergate levels were also visited. It was not unusual to see both Pink-feet and White-fronts feeding together. The maximum numbers were attained between 1938 and 1946 despite a wartime network of tubular steel barriers erected on the marshes to prevent an airborne invasion. The final peaks were obtained in 1943 and 1946; on both occasions 3,000 were estimated by R. H. Harrison. The earlier total was recorded 26th December 1943 on Mautby-Runham marshes. Earliest autumn arrivals were recorded during the latter part of September, but the first parties seldom stayed any length of time. There was then a gap until late October when the main flights arrived. In 1936, for example, 1,000 Pink-feet were feeding on the lower Bure marshes on 30th October.

After spending the short winter day on the marshes, the Pink-feet normally returned to Scroby to roost. During periods of fog, exceptional high tides and gale-force winds however, the birds avoided heading to sea. In these conditions Breydon estuary was favoured despite disturbance. Normally diurnal feeders, at the times of full moon the Pink-feet regularly fed at night.

After 1947 Halvergate and the lower Bure marshes steadily declined as a wildfowl resort. The introduction of electric pumps resulted in the old drainage mills falling into decay. Each succeeding winter saw less and less flooding and greater disturbance. Inevitably pink-

feet numbers fell each winter and had declined to 450 in 1950/1, 150 in 1952/3 and 100 in 1955/6. During the following decade winter totals did not excede 40 birds. Since then small groups have put in only very brief and occasional appearances. Higher up the Yare Valley Pink-feet continue to be detected amongst wintering Bean Geese, but apart from a gaggle of 60 briefly on 17th December 1988 only ones and twos have been reported.

West Wash/Fens: Withdrawal from north Norfolk by 1941 and from the Broads grazing levels during the 1950s was fully offset by an increase along the Lincolnshire shore of The Wash. This was a new tradition; at the same time feeding habits changed completely. The pattern of these movements is included for the sake of completeness and because it also sheds light on today's habits. Research by Cambridge Bird Club confirms that during the late 1940s and 1950s a regular Pink-foot arrival and build-up to 7,000 and even 10,000 birds took place each autumn on the West Wash at Wainfleet from October before a move was made to Holbeach by mid-November or December. From here over 5,000 moved inland to the Cambridgeshire Fens from January until early spring. This pattern varied little up to 1962. The Pink-feet used the Nene Washes (some 20 miles inland) as an overnight roosting area, moving out to farmland to feed during daylight hours. Luckily farmers welcomed these wandering flocks. These geese gathered on fields of harvested potatoes, where the tubers left formed a major part of their diet; otherwise they grazed winter wheat. The first activity greatly reduced the number of potatoes growing in following cereal crops as weeds. Feeding on main shoots of growing corn produced more side tillers, beneficially thickening the crop.

Just how important the Nene Washes had become was all too clear in 1963 when much of the grassland along the eastern half was ploughed and the geese failed to return. This sudden conversion to arable came at the time The Wildfowl Trust was negotiating the possibility of setting up a wildfowl refuge on the Nene Washes. The inland roosting habit which had developed on the Nene has rarely extended to the Ouse Washes. At the latter site a combination of unpredictable flooding covering feeding areas on the washes themselves and shooting pressure levelled against geese using arable for feeding (and the washes for roosting) has prevented any traditional use becoming established. Hence parties usually move on after a short while.

East Wash/Snettisham: There are scattered reports of geese visiting the East Coast of the Wash from the early years of this century including an intriguing reference by Dr. Riviere to 2,000 Pink-feet and White-fronts feeding on Snettisham fresh-marshes during very hard weather in February 1929. Then in 1956 329 Pink-feet were recorded in January. During later years flocks of 200 to 300 were frequently seen. But it was not until the 1968/9 winter that monthly figures first became available including a peak of 843 birds in February.

Peak counts at Snettisham

1969/70	1,348	1974/75	2,400	1980/81	2,450
1970/71	1,093	1975/76	2,731	1981/82	10,500
1971/72	1,274	1976/77	3,700	1982/83	5,400
1972/73	1,816	1977/78	4,572	1983/84	7,000
1973/74	1,784	1978/79	2,370	1984/85	9,500
		1979/80	3,720		

More recent counts appear on page 419

Scolt Head: A full decade after the commencement of the Snettisham build-up, 90 Pink-feet began roosting at the western end of the island between 20th November 1979 and

19th January 1980. As the site became more 'traditional' so the numbers rapidly increased.

Peak counts at Scolt Head

1981/2	3,500	1983/4	13,000
1982/3	5,600	1984/5	9,300

More recent counts appear on page 419

Effect of the Moon: When undisturbed Pink-feet feed during the day and flight to their roost any time from near sunset until an hour or so afterwards. On occasions, however, departure may be delayed until conditions of practically total darkness as far as the human eye is concerned. The only time navigating ability breaks down is in mist and fog. Gales do not deter them. For example on 25th January 1990 the geese — despite being swept well off-course — continued battling against WNW storm-force 12 winds to reach the Scolt roost at dusk.

At periods when the moon is of any extent and is riding in the night-time sky the geese may be heard flying to and from the roost throughout the night, often flighting in as the moon rises in the evening. Particularly in mid-winter when the moon is full they are liable to stay in the fields all hours of the night only returning to the roost when it pleases them. Moonlight feeding sites need to be very secure having almost always been used during the previous days. The birds are well aware which flight paths and farms are 'safe'.

Overnight Roosts: The Pink-feet roost-site off Snettisham occupies the centre of a 3,000 acre wildfowl refuge and offers relative safety and no enemy can approach undetected. The high tides at night cause the geese to float on the water before settling later on the mud and sandbanks. Ever wary, they may stand up to a mile offshore on Peter Black Sand and Ferrier Sand. At Scolt Head the most regularly used area is amongst the sand and shingle ridges at the extreme western end of the Island. Depending on the tide, the geese remain on the ridges avoiding the dunes. The muddy Cockle Bight area is occupied during strong northerly winds when the dunes provide shelter. During calm conditions the birds are content to roost on the open sea off the Far Point and Cockle Bight.

The Wells roost is situated on very exposed sandbars and shingle ridges off Lodge and Warham Marshes and on Stiffkey High Sands. This roost-site attracts the 'meadow' feeders from Holkham fresh-marshes and also the Pink-feet attracted to inland fields west of Wighton.

As the light fades the evening flight commences and small and large formations begin arriving — often from more than one direction. On windy nights arrival is often more prolonged than on calm ones. Each flight turns upwind before side-slipping and tumbling out of the sky to the estuary. After the first geese are settled, later arrivals fly in without the hesitation often displayed by the first arrivals. Coming in to roost there is usually a great clamour, redoubled whenever a fresh assembly arrives with greeting calls from the new arrivals. Some time after the last flight comes in the chorus steadily falls to a low level which is often maintained until an hour or so before dawn flight when it increases again.

At daybreak the geese return to the fields chosen as feeding grounds. The vanguard alights usually as near the centre as possible after circling several times and after more than one 'failed' attempts to settle before actually doing so. The build-up then becomes rapid with a succession of newcomers settling without hesitation. Roosting Pink-feet usually separate into several feeding flocks travelling at varying distances and directions from the roost. During the day groups move between flocks and also between feeding and roosting places, following disturbance inland during pheasant shoots and movements of farm vehicles.

The birds feed least around mid-day.

Morning flight usually lasts between 30 and 45 minutes, but may extend for well over an hour depending on the state of the tide and the moon. Delay in departure from the Scolt Head roost following moonlight feeding is most noticeable on a rising tide at high water. These conditions enable the geese to bathe readily and to preen. Off Snettisham they may be observed splashing in the creeks before flighting. In addition there are occasions when birds are still returning to roost at dawn. These late arrivals perhaps 'encourage' the main assemblies to linger.

Feeding: Newly arrived, Pink-feet favour feeding on spilt grain in stubble, but the principal diet between October and January/February is discarded sprouting sugar-beet tops. This habit was first recorded locally in February 1966, but surprisingly no reference is made to it in *Wildfowl in Great Britain* (1986). After the remaining beet-tops are ploughed-in (usually by mid-January) the Holkham-based birds feed mainly on permanent grassland and on winter cereals. At Snettisham during February/March the Pink-feet have favoured old water meadows for feeding. But early in 1990 following the close of the wildfowling season up to 8,000 regularly fed on salt-marshes.

Usually the most extensive fields are favoured and especially those nearest to roost-sites. Small fields and also tall hedges which restrict the view are avoided. The un-easy co-existence with the farming community invariably results in some disturbance. Fortunately, individual farmers are extremely tolerant and prepared to considerably delay ploughing-in beet-tops so that they may enjoy one of winter's finest wild life spectacles: flighting geese.

The main feeding area in north-west Norfolk extends eastwards as far as the Holkham Estate. Normally, the southern limit is the main A148 Fakenham to King's Lynn road, but during the 1989/90 winter regular flights appeared towards the B1145 in the vicinity of Peddar's Way. Pioneer groups of Pink-feet are beginning to visit cleared beet fields much further to the east.

Severe Weather: At the onset of a heavy snowfall the vast majority of Pink-feet depart, failing to return until the following autumn. During the 1986/7 winter, for example, severe frost on 9th January quickly followed by snowfalls and with drifts in the Brancaster district of 10 to 15 feet caused complete abandonment of the Scolt roost. Yet at Snettisham up to 2,300 Pink-feet continued roosting until mid-March.

A Pink-foot disaster took place soon after dawn on 3rd January 1978 when a violent storm complete with thunder, lightning and hailstones, crossed East Anglia. In its wake 140 wild geese (mainly Pink-feet) lay dead in fields, along hedgerows and on roads. It is highly probable that the birds involved formed part of the Snettisham flock. The most likely sequence of events was that the geese were flighting along the southern perimeter of The Wash at dawn — or panicked into the air by the approaching storm — were overtaken by a tornado or funnel cloud and forcibly sucked upwards to a considerable altitude like toy balloons. Death or unconsciousness quickly followed. Their involuntary return to earth became only a matter of time and occurred along a 30 mile-path extending from near Castle Acre to just south of Norwich. The numbers of Snettisham-based Pink-feet declined that day from 4,540 to 640 thereafter, dispersed by the high winds.

A similar incident was recorded by J. H. Gurney on the north Norfolk coast on 8th February 1906: 'About 2 pm a violent storm of snow and hail accompanied by 20 minutes of incessant lightning blew up from the north-west. This combination caused a stampede among nearly 4,000 Pink-footed Geese at Holkham fresh-marshes. Flying resulted in fatal results in several cases. Nineteen geese (15 Pink-feet and four White-fronts) were picked-up in the adjacent parishes of Bayfield, Holt, Kelling and Weybourne all struck by lightning'.

Co-ordinated Counts: The presence of very substantial numbers of Pink-feet in north-west Norfolk warranted co-ordinated counts at dawn followed by feeding estimates. These arrangements commenced in December 1985.

Peak totals of Pink-footed Geese at Snettisham, Scolt and Holkham

1985/6	19,900	1987/8	18,800	1988/9	13,500
1986/7	19,800			1989/90	26,920

Reference to papers in the Annual Reports of The Wildfowl Trust confirms that Pink-foot roosts within Britain are not self-contained. A continual shifting of birds from roost to roost around the country has been confirmed by counts, by numerous ringing results and by radio tracking work carried out by Aberdeen University. In fact recoveries of geese ringed near particular roosts during the period 1951 to 1959 came within the following three months from all parts of the winter range. Movement may take place on any date and not only in response to hard weather or food shortages. As might be expected inter-change is greatest between adjacent roosts and in Scotland groups of roost-sites function as one. There is evidence that this is the situation locally, particularly as the Snettisham and Scolt Head roosts are only 12 miles apart. Observation has shown that the Snettisham-based Pink-feet feeding at Babingley may be joined by others flighting in from the north and presumably from Scolt. During the 1989/90 winter a morning flight count at Scolt on 10th November, for example, revealed a one-off total of 7,000 birds compared with 2,200 geese there the previous day. Peak numbers at Scolt were attained during the second and third weeks of January 1990, but by the 29th a high proportion had shifted allegiance to Snettisham where 19,000 assembled. During the same winter interchange was first noted between the Pink-feet roosting on Scolt and those spending the night off Wells/Stiffkey; at 4 p.m. on 26th December a flight of several thousand south of Burnham Market separated with 1,500 heading towards Wells and the remainder alighting on the Far Point at Scolt. In addition the 1989/90 winter has seen the first Pink-feet feeding on Burnham Norton fresh-marsh in association with Brent Geese.

The factors that influence roost preference must remain a matter of speculation. But a spring tide and a strong northerly wind certainly makes The Wash uncomfortable for wildfowl. It may well be that the relative shelter offered by the shingle ridges of Scolt Head's Far Point provides calmer conditions. Very occasionally Pink-feet have been observed to roost elsewhere. One report cites an inland lake and another inland fields.

Throughout the 1950s The Wildfowl Trust ringed large numbers of Pink-feet both in Iceland and in Britain. But it was not until 28 years later that a new marking programme commenced. One of the early results was that the long suspected link between the Lancashire geese and the Norfolk gatherings was confirmed by a goose ringed in April 1987, resighted at Martin Mere in December 1987 but which subsequently moved to spend the mid-winter period at Holkham. The 1989/90 winter has resulted in further evidence that the group centred on Martin Mere in late autumn contains many birds staging before moving northward to Scotland and also to Norfolk for part of the winter. A total of nine Pink-feet caught and ringed at Martin Mere between 31st January 1987 and 28th October 1989 has been reported in north Norfolk, together with two individuals both shot on the east shore of The Wash. All the Martin Mere birds have been caught using cannon-nets fired over them whilst feeding on waste potatoes. They were fitted with a standard BTO ring on one leg and a white plastic ring bearing a unique three-letter code on the other.

Arrival and Departure: A decade ago the first arrivals did not put in an appearance until the last week of October. Nowadays, parties appear shortly after mid-September followed by main arrivals by late November. Peak numbers are attained during December often

remaining until well into January. Provided the weather continues open the assemblies may still be high during February and exceptionally until late March.

Few remain in April although a remarkable 500 were on The Wash on 4th April 1984. And a party of eleven was reported there 1st May 1982 with three lingering until the 11th. These late stayers resort to the most isolated and distant saltings.

Acknowledgements: Special thanks are due to John Brown, Dr. Tony Fox (Wildfowl & Wetlands Trust) and Dr. Michael Petch. In addition the following observers have assisted in a variety of ways: Colin Campbell (Nature Conservancy Council), Edward Cross, Graham Easy, Paul Fisher (RSPB), David Henshilwood (NCC) and John Kemp (W & WT).

Yellow-browed Warblers in Norfolk

A. M. Stoddart

The Yellow-browed Warbler has long been known to wander to Western Europe. For example Gatke recorded 80 individuals on Heligoland between 1846 and 1886. The race involved, (*P. i. inornatus*) breeds in northern and central Siberia, extending as far west as the Urals in the northern part of its range, as far east as the Sea of Okhotsh, and wintering in south-east Asia. Its history in Norfolk is less well established although there were seven autumn birds at Cley and one at Yarmouth in the period up to 1961.

Since then, however, recorded numbers have escalated dramatically and the last thirty years have produced a minimum of 343 or 98% of the all-time total. The purpose of this article is to document the occurence of this species in Norfolk and 1989 falling as it does at the end of a decade seems an appropriate point at which to do so. The annual totals of Yellow-browed Warblers in the county over the last thirty years are tabulated below. In each year the number is an absolute minimum as true numbers are hard to assess with total accuracy where there is a continuous presence over a long period at one site and where arrivals and departures may go undetected as a result.

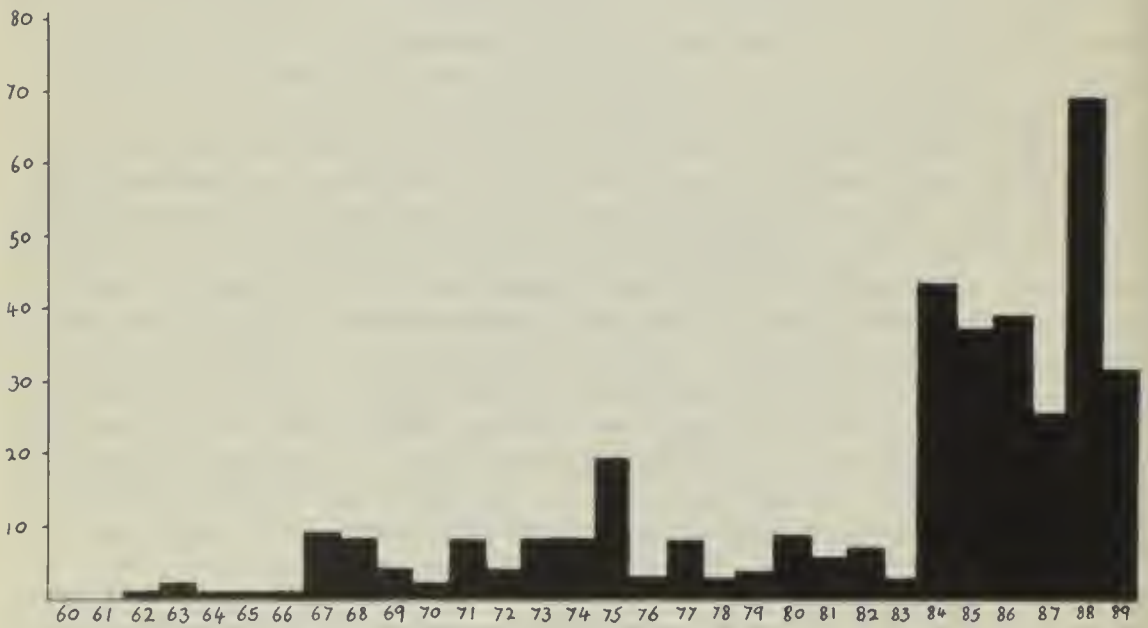
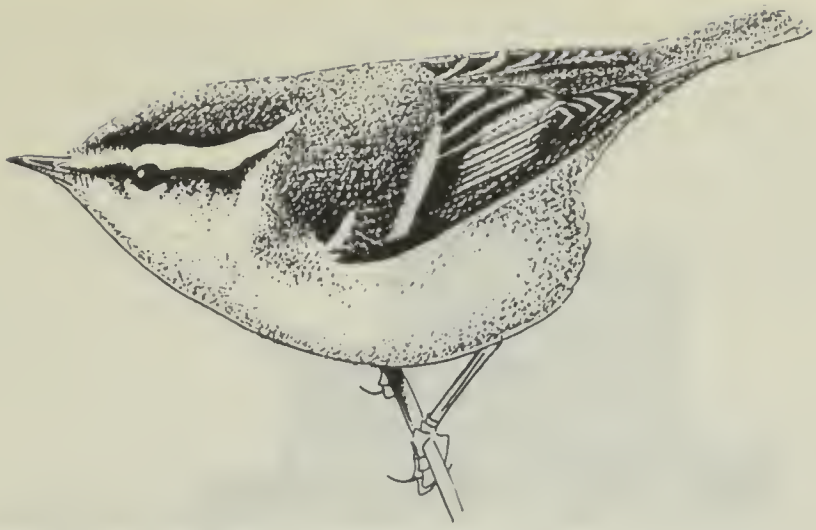


Figure 1. Annual totals of Yellow-browed Warblers in Norfolk 1960-89.



The recent change in status is dramatically illustrated here. Both 1960 and 1961 were typical years for their time with no records but 1961 was to be the last completely blank year. The total of nine in 1967 was extraordinary at the time and numbers did not exceed this for another sixteen years with the exception of 18 in the 'classic' autumn of 1975. The recent upsurge is clearly seen as beginning in 1984 since when numbers have never fallen even to the 1975 level. Not surprisingly, the Norfolk histogram matches very closely the national picture presented in *Rare Birds in Britain and Ireland* (1989)

The influxes of the mid and late 1980's, accounting for 66% of the all-time total, have all been very similar in nature and have produced an occurrence pattern which is matched by no other species. Their arrival is now expected on or soon after 15th September (although the occasional bird elsewhere in south-east England has turned up as early as the 12th) with a scatter of records superimposed upon 'pulses' or waves' of occurrence. A typical example of one of these mass arrivals occurred in early October 1986. On the 4th only 2 birds were present in the county: at Holme and at Holkham Meals. Several hours searching at this latter site from dawn on 5th produced only one, but the prevailing calm anticyclonic conditions led to a strong arrival during the day and by the close of play ten were in Holkham Meals and 7 others had been found elsewhere in the county. This type of arrival has now become quite common with a sudden mass influx followed by a fairly rapid decline in numbers. For example, in the most impressive year to date — 1988 — the influx of at least 21 new birds to Norfolk on 12th October dwindled rapidly and none was present anywhere after the 24th despite further small arrivals during the intervening period. New arrivals are rare after 10th November and almost unknown after 15th and have no correlation with the years providing the largest numbers as illustrated by 1988. The very few late birds which do occur tend to linger for longer as they arrive outside the main westward movement. Thus a bird at Holkham 3rd November 1968 remained until 1st December, one of only three ever to be recorded in this month. Another of these arrived at Walsey Hills on 3rd December 1967 and stayed until 7th January 1968 when hard weather set in and put a premature end to the only attempted wintering on record. Finally a bird remained at Winterton from 1st to 8th December 1989. This individual was noteworthy in that it showed voice and plumage characters typically associated with the race *humei* of south central Asia. The small number of these to have been documented in Britain have all occurred noticeably late in the autumn, in a time-slot more typically occupied by the partly sympatric Pallas's Warbler. The histogram below profiles the presence of Yellow-browed Warblers during the 1980's:

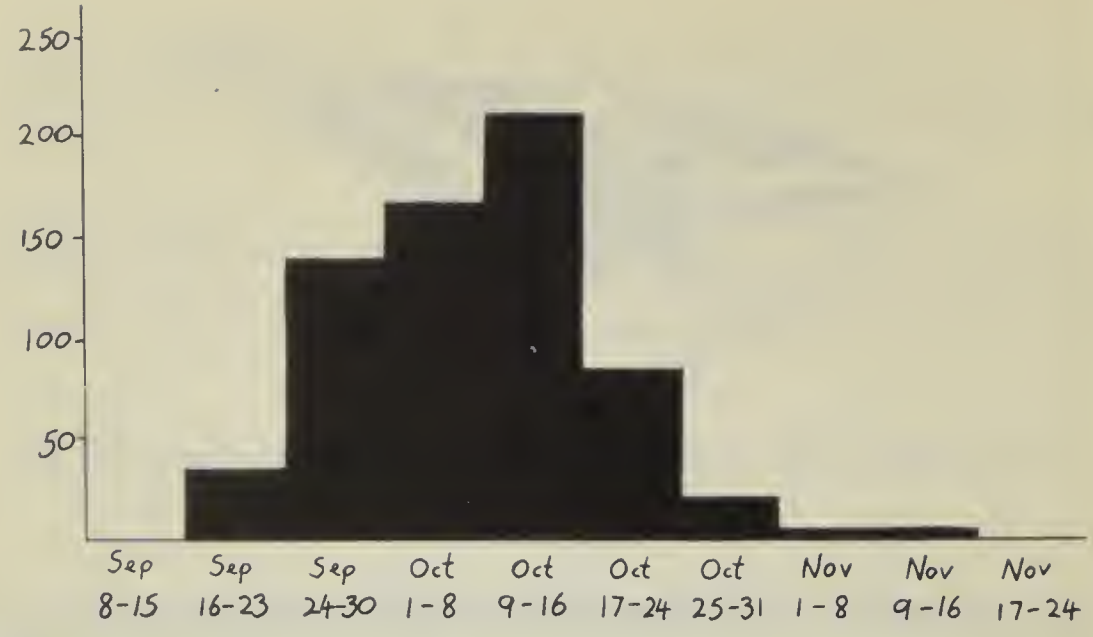


Figure 2. Profile of Yellow-browed Warbler presence in Norfolk during the Autumns of 1980-89 as shown by bird-day totals for each 'week'.

Such a profile is typical of the whole of East Coast England as shown by Baker and Catley (*British Birds* 80:93-109). Their tables, however, attempt to show new arrivals while the table here shows a cumulative presence across the ten autumns and so reflects more the build-up and decline in numbers. For example, an imaginary bird staying from 16th September to 16th November in one of the years would be recorded once for every day of its stay and would count as eight bird-days in each histogram column. Norfolk's profile fits neatly into the national picture showing a pattern intermediate between the far north-east of Scotland where a much greater proportion of Yellow-browed Warblers occurs in September and south-west England where September arrivals are few, the peak occurs in the second and third weeks of October and a greater proportion occur later than this. This doubtless reflects both onward filtration of birds through the country as well as a shifting centre of gravity of new arrivals from north-east to south-west as the autumn progresses.

This rapid onward movement through Norfolk and through Britain gives this species' arrivals an almost irruptive quality. Certainly their single-species arrivals more closely resemble, in some respects, those of say Waxwing than other small Palearctic passerines. All this is evidence of a continuing strong migratory urge. Newly-arrived Yellow-broweds are usually highly active and vocal and many, particularly at less suitable sites, may move on very quickly indeed. This implies that perhaps the numbers involved are being under-recorded, not only at such sites where short-stayers may get missed altogether, but also at prime sites — particularly Holkham Meals — where a sustained high number over several days probably masks departures and new arrivals. Each year bears witness to the apparent amazing ability these birds have for finding these optimum habitats with Holkham Meals and its sallows and tit flocks always taking the lion's share, whereas other traditionally productive migrant spots such as the suaeda of Blakeney Point always fare particularly badly, this site having produced only 4% of all Norfolk's Yellow-broweds. This must suggest that either a degree of 'coasting' goes on after an initial landfall or that birds hitting the coast in a random scatter rapidly move inland if no good coastal cover is encountered. Once past the coastal strip such birds would become near-impossible to locate

as evidenced by a total of only four inland records ever.

It is perplexing to speculate on the factors which, in the space of thirty years, have turned Yellow-browed Warbler from a longed-for vagrant into an anticipated sub-rarity. To a great extent we observe but we cannot explain. Observer coverage clearly plays some part and in the early years they must have been greatly under-recorded in Norfolk as they were in the rest of Britain compared with the steady numbers reaching Heligoland. Even as recently as the period 1958 to 1967 discussed by Sharrock (1974) Norfolk only recorded 15 out of the 275 known to have reached Britain. However, if observer numbers and expertise were the only factors affecting recorded numbers then a steady and even increase might be expected and not the dramatic explosion of sightings which took place to a limited extent in 1967 and 1975 and then more fully in 1984 onwards.

Weather patterns must have some influence too. It has now been well demonstrated that the persistence of large anticyclones over the Siberian breeding range in early autumn produces a gentle easterly airflow conducive to westwards drifting of Yellow-browed Warblers on post-juvenile dispersal. Penetration then ensues into Europe and birds have traditionally reached Norfolk in falls of Continental migrants, for example Redstarts and Sylvia Warblers in September or Thrushes and Goldcrests in October occasionally alongside Siberian counterparts, as in 1975. The influxes of the 1980s have fitted less easily into this pattern and waves of birds now arrive on any weather pattern, unless it is totally unsuitable. Anticyclones centred over Britain, the southern North Sea or the near-Continent with their resultant calm settled conditions have proved to be especially suitable for birds to jump the North Sea and arrivals on north-westerlies no longer raise eyebrows.

Weather patterns in Norfolk in late September and October, however, merely facilitate the final stages of a process which commenced several weeks earlier and thousands of kilometres away. More fundamental factors must be at work to explain recent events, perhaps linked to high population levels or range expansion. The answer must be found at the species level for arrivals of Yellow-browed Warblers show little correlation with any other species and rarely bring other Siberian birds with them. It is perhaps significant that the only species to share a similar history is one of Yellow-browed's closest relatives: Pallas's Warbler. Their breeding ranges do not wholly coincide, Pallas's arrive consistently later and their peak years do not coincide either, but they do have a history of gross rarity coupled with a recently established new plateau of occurrence and a remarkable 'big' year (1982 in the case of this species). Maybe we are entering, therefore, a new era of activity from this complex and dynamic genus. Data concerning ranges and numbers will not be readily forthcoming from such a vast and birdwatcher-less area as Siberia so we will have few clues about Yellow-browed Warbler's future status here unlike the more fully documented westward expansion of Greenish Warbler.

One can only guess whether these Asian waifs will continue to visit Norfolk in such numbers. I, for one, will be eagerly anticipating each September 15th and straining for their familiar calls from amongst the sallows and sycamores.

Publication of this feature has been subsidised by a donation from Mr. Christopher Cadbury

Yellow-browed Warbler showing characters of the race *humei*

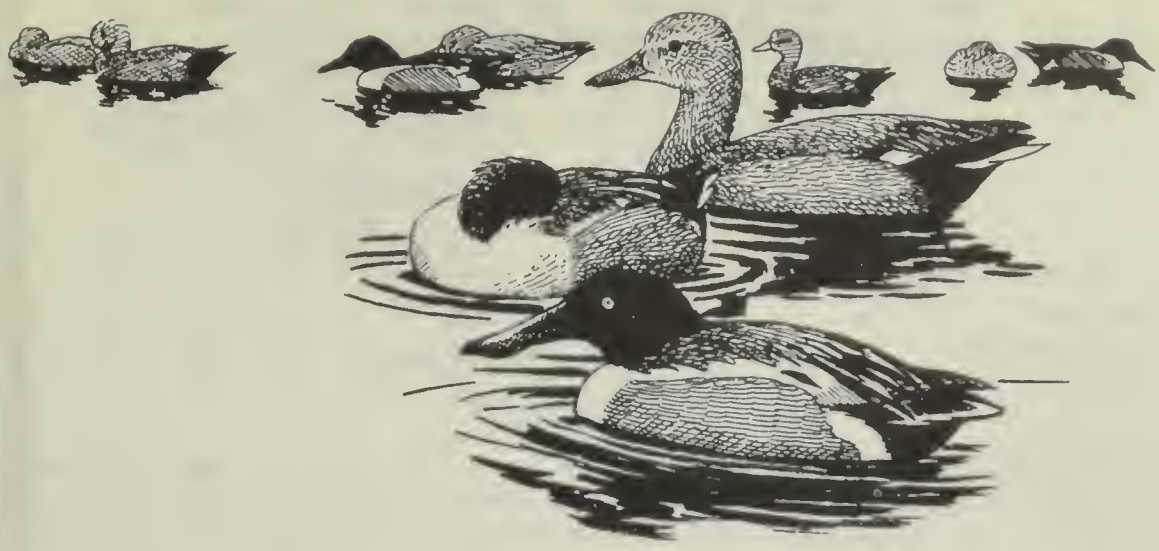
A. M. Stoddart

Between 1st and 8th December 1989 Peter Cawley observed a Yellow-browed Warbler in Winterton village. In company with P. Heath and A. Lewis I visited the locality on the 3rd. The bird was soon located in a small stand of oaks where it fed very actively with much hovering and 'parachuting' through the foliage. After several unsatisfactory views it started calling and I was very surprised to hear what was apparently the typical call of the south-western race *humei* — a disyllabic note with the accent on the first syllable and falling in tone on the second, sometimes slurred into more of a monosyllable. It can perhaps best be transcribed as swee-oo, lower in tone than *inornatus* and with a slight harsh or rasping quality reminiscent of House Sparrow and therefore totally unlike the familiar *inornatus* call.

Close attention to the bird's plumage showed that the plumage was consistent with *humei*. Upperparts were a dull olive with a subtle grey tone, looking quite pale in strong light and similar to a pale *abietinus* Chiffchaff. The buffy-white supercilia did not bridge the base of the bill and they were ill-defined with no darkening at the crown-sides and a rather diffuse eye-stripe particularly on the lores. Ear-covers appeared almost unmarked. Underparts were again somewhat Chiffchaff-like with a dingy greyish-white ground colour with grey diffuse streaking across the breast and buffy flanks. Median covert wing-bar was buffy-white and short and thin, but the greater covert-bar was typically bright and prominent. The tertial fringes were white, but rather narrow and the white primary tips were small but intact. Bill looked thin and dark on all but the closest views when at least the basal third of the lower mandible was seen to be flesh-coloured. Legs looked consistently dark and Chiffchaff-like.

Although usually described as an eastern race, *humei* actually has a south-western distribution, occupying the great mountain ranges of south central Asia and wintering in the Indian sub-continent. Racial diagnosis always brings the danger of 'wishful labelling' as distinctions tend to be clinal in nature. For example, birds resembling *humei* have been collected from areas outside their supposed range. There is also a third race *mandellii* to consider which, although unlikely to reach Europe, shares many *humei*-type characters and can be regarded as intermediate between *humei* and *inornatus*. It can be said, however, that very small numbers of Yellow-browed Warblers showing *humei*-type characters do reach Britain. These birds possess a consistently dull appearance, dark legs and — most importantly — a distinct and unvarying call which readily sets them apart in the field. Their appearance and call are therefore clearly at variance with typical examples of the more northerly and easterly Siberian *inornatus* and their origins are presumably different too. Their true national status is somewhat clouded but a pattern of late autumn occurrences has emerged, not surprising as *humei* is at least partly sympatric with other now expected late autumn vagrants such as the increasingly obvious Pallas's Warbler.

The only previous reference to a bird showing *humei* characters in Norfolk concerns a bird at Wells from 19th to 27th October 1974.



1988/89 Norfolk Wildfowl Counts

National wildfowl counts are organised by the Wildfowl and Wetlands Trust under contract to the Nature Conservancy Council. Swans, geese and ducks are covered, together with certain additional wetland species, at as many wetlands (coastal and inland) as possible from September to March. The figures include that section of the Ouse Washes extending from Welney to Welmore.

	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Sites Counted	29	29	30	29	29	28	25
Little Grebe	26	38	73	37	50	69	60
Great Crested Grebe	124	164	92	82	104	95	96
Cormorant	183	686	581	686	740	685	321
Mute Swan	246	194	446	375	448	456	277
Bewick's Swan	7	6	1442	2200	3902	2543	65
Whooper Swan	3	31	291	582	524	552	538
White-Fronted Goose	0	0	30	302	407	673	72
Greylag Goose	1717	2112	2212	1713	1564	1869	1323
Canada Goose	1017	915	1152	1169	934	755	342
Brent Goose	16	2377	8510	9913	11174	8752	5510
Egyptian Goose	66	75	77	36	26	46	17
Shelduck	946	1792	1156	1085	914	2588	2083
Wigeon	3078	9677	22996	24263	25721	17673	13319
Gadwall	721	481	362	510	460	415	291
Teal	3170	3537	3444	3863	5493	2488	2992
Mallard	5186	5479	5533	6174	6499	4930	1918
Pintail	517	1044	1208	618	748	1534	263
Shoveler	285	257	340	442	483	368	505
Pochard	168	383	965	1561	1340	1860	1309
Tufted Duck	412	636	764	567	944	736	888
Scaup	3	0	1	0	0	15	0
Eider	3	7	12	142	61	93	204
Long-Tailed Duck	0	0	32	22	23	27	37
Goldeneye	0	61	132	115	174	210	171
Red-breasted Merganser	4	74	118	70	71	43	85
Coot	1248	1208	1480	1402	1413	1413	1066

Birds of Estuaries Enquiry, 1989 Complete Wash Counts
(organised by BTO Estuaries programme staff)

	15 JAN	12 FEB	12 MAR	9 APR	7 MAY	23 JUL	20 AUG	17 SEP	15 OCT	18 NOV	17 DEC
Little Grebe	8	13	11	6	—	3	—	9	23	55	24
Great Crested Grebe	37	24	17	15	25	33	65	35	96	8	9
Cormorant	235	175	206	100	51	68	213	160	201	157	108
Mute Swan	20	20	24	30	46	16	5	21	6	21	11
Bewick's Swan	12	28	1	—	—	—	—	—	—	9	23
Pink-footed Goose	9382	4246	820	1	—	1	1	1	1204	8505	8500
Brent Goose	24396	22196	14240	14078	11496	9	4	22	5192	13887	14379
Shelduck	15613	14147	5734	5010	2231	4809	2649	2026	5306	19091	8977
Wigeon	1331	740	231	4	—	—	128	643	674	1910	1130
Gadwall	59	60	49	23	7	—	1	12	—	40	51
Teal	362	261	131	58	5	24	879	633	218	838	967
Mallard	2975	2665	643	454	290	149	414	1335	1864	3068	2161
Pintail	6541	3959	93	16	2	—	66	559	146	2053	1053
Pochard	46	77	22	—	—	2	2	3	29	17	24
Tufted Duck	79	64	23	48	34	32	13	21	19	41	38
Scaup	4	12	3	—	—	—	1	—	—	—	1
Eider	276	148	107	98	280	330	135	88	36	51	68
Long-tailed Duck	127	24	63	40	3	—	—	—	—	—	—
Common Scoter	80	372	510	33	541	1	7	—	—	—	225
Goldeneye	111	105	86	41	—	—	1	—	28	47	92
Red-b Merganser	119	49	142	108	16	—	—	5	42	28	63
Hen Harrier	7	7	5	2	—	—	—	2	3	8	7
Merlin	3	7	5	—	2	—	—	1	4	1	3
Oystercatcher	46912	37090	25235	17175	8878	11668	36719	44947	32920	30628	17183
Avocet	1	1	46	53	64	6	117	32	1	5	1
Ringed Plover	97	135	239	265	595	515	2409	475	374	142	49
Golden Plover	3568	2673	1023	721	40	1014	2816	1335	1621	1048	1057
Grey Plover	7322	5115	9054	8441	10804	4296	9493	8047	7304	4712	2968
Lapwing	4821	4943	129	95	133	502	917	1556	1306	4303	3472
Knot	72541	66041	49374	28922	10818	11030	39324	76697	157594	82503	54305
Sanderling	411	255	435	467	643	3148	786	1277	49	248	110
Purple Sandpiper	22	20	11	12	—	—	1	—	—	10	—
Dunlin	45610	51061	48720	58248	50241	44531	24362	29995	47732	20954	24172
Ruff	4	1	—	7	24	22	33	6	—	—	—
Snipe	9	47	34	22	12	34	66	32	21	31	15
Black-tailed Godwit	—	90	26	290	18	436	448	292	840	664	91
Bar-tailed Godwit	5682	5604	1726	1114	1209	7083	6966	2088	6052	1104	4102
Whimbrel	—	—	45	—	192	336	310	30	51	1	—
Curlew	3080	3796	3254	3701	1173	7334	11663	7875	5973	2664	1442
Spotted Redshank	—	—	3	2	13	2	16	70	28	1	—
Redshank	4003	4069	4619	5218	1246	4093	8043	9641	5070	2271	2332
Greenshank	—	—	—	2	44	272	137	132	29	4	1
Common Sandpiper	—	—	—	—	18	59	67	20	—	—	—
Turnstone	645	666	1282	1643	1200	859	822	874	786	553	456
Short-eared Owl	12	18	18	32	14	2	—	6	18	5	2
Twite	1761	2112	989	329	—	—	—	12	737	2854	2003
Snow Bunting	261	131	—	—	—	—	—	—	—	21	47

Birds of Estuaries Enquiry, 1989

North Norfolk Coast

The monthly counts Jan to March cover Titchwell, Brancaster/Scolt, Wells harbour and Warham/Stiffkey. The Oct/Nov figures exclude Holme, Overy Harbour, Holkham Bay and Salthouse, but are otherwise complete. The Dec count is complete Holme to Salthouse excluding only Holkham Bay.

	JAN	*FEB*	*MAR*	*OCT*	*NOV*	*DEC*
Great crested Grebe	—	—	8	17	5	6
Cormorant	23	19	10	107	38	68
Mallard	660	238	41	691	1007	1661
Teal	680	285	42	1482	2244	7290
Wigeon	—	36	2	6865	5327	6078
Pintail	—	3	—	301	1090	561
Shoveler	—	—	—	33	63	64
Goldeneye	60	56	32	22	54	105
Eider	101	191	195	51	41	30
Red-breasted Merganser	18	14	12	30	29	51
Shelduck	603	360	256	529	1350	1861
Greylag Goose	—	—	—	153	352	391
White-fronted Goose	—	—	—	—	19	224
Brent Goose	4162	5197	809	4141	8186	5973
Canada Goose	—	—	—	99	47	93
Mute Swan	22	1	3	46	28	55
Oystercatcher	3526	3169	2371	5132	5302	3909
Lapwing	—	355	—	517	2130	6023
Ringed Plover	78	131	142	313	154	158
Grey Plover	320	315	117	601	664	548
Golden Plover	45	—	—	443	976	224
Turnstone	245	252	141	344	291	234
Common Snipe	—	—	—	81	39	42
Bar-tailed Godwit	236	423	171	442	1598	519
Curlew	422	502	573	691	672	408
Redshank	313	366	379	776	532	685
Spotted Redshank	—	—	—	4	1	—
Greenshank	—	—	—	5	—	2
Knot	2980	1075	—	1124	6523	2235
Dunlin	1226	1503	501	2715	2123	2628
Sanderling	37	60	12	114	90	157
Ruff	—	—	—	17	29	1

Birds of Estuaries Enquiry, 1989

Breydon/Berney Marshes Monthly Maxima

	JAN	FEB	MAR	APR	MAY	JUL	AUG	SEP	OCT	NOV	DEC
Great Crested Grebe	4	4	7	9	30	25	42	39	18	21	33
Cormorant	71	85	69	51	34	61	131	180	121	97	95
Spoonbill	—	—	—	1	1	1	1	1	—	—	1
Mute Swan	119	110	79	61	71	43	39	41	89	180	197
Bewick's Swan	196	698	402	—	—	—	—	—	16	128	189
Bean Goose	2	46	—	—	—	—	—	—	—	—	—
Greylag Goose	73	72	65	46	37	55	77	83	84	86	128
White-fronted Goose	16	270	—	—	—	—	—	—	—	12	21
Brent Goose	1	5	3	—	—	—	—	—	12	7	10
Barnacle Goose	—	11	—	2	7	—	—	—	—	—	—
Canada Goose	29	26	8	4	4	25	6	11	9	10	26
Shelduck	174	203	241	301	346	308	43	123	225	201	198
Garganey	—	—	—	1	5	—	—	—	—	—	—
Wigeon	1000	1500	700	49	3	—	2	46	72	600	400
Pintail	163	143	21	8	2	—	—	11	36	70	105
Teal	202	120	271	136	7	6	42	34	52	200	101
Mallard	173	261	52	30	41	15	28	24	87	115	218
Gadwall	52	54	33	32	15	—	2	3	4	32	37
Shoveler	60	66	120	75	22	25	4	7	14	22	17
Tufted Duck	2	3	3	5	6	1	9	8	1	1	5
Pochard	10	10	9	6	3	1	—	6	11	1	4
Goldeneye	7	7	—	—	—	—	—	—	1	2	12
Curlew	424	343	321	254	80	153	410	452	437	530	524
Bar-tailed Godwit	—	—	1	11	59	11	12	13	7	8	7
Black-tailed Godwit	—	1	2	18	20	17	2	1	—	1	1
Knot	262	237	69	22	20	15	30	37	23	51	84
Sanderling	51	41	38	10	7	1	1	1	4	46	41
Turnstone	21	19	17	29	18	7	26	12	15	23	20
Snipe	150	89	40	20	2	4	16	30	33	200	117
Dunlin	1200	1100	950	870	1100	312	1200	1050	900	1100	1400
Ruff	21	26	28	13	50	13	30	22	10	18	28
Redshank	420	570	600	400	37	550	730	700	430	580	800
Spotted Redshank	—	2	1	5	3	6	5	4	2	1	2
Greenshank	—	—	—	3	15	12	45	12	3	—	—
Green Sandpiper	1	—	1	1	—	4	5	2	2	2	1
Common Sandpiper	—	1	—	5	10	7	20	4	3	1	—
Wood Sandpiper	—	—	—	—	6	1	—	1	—	—	—
Ringed Plover	91	74	37	56	262	20	261	259	188	88	77
Grey Plover	46	49	37	28	28	2	5	20	18	17	14
Golden Plover	45	80	12	36	2	1	240	600	450	800	900
Lapwing	5000	6000	1000	70	36	77	106	300	570	500	5500
Avocet	—	1	2	5	4	6	8	3	2	1	—
Whimbrel	—	—	—	42	18	11	6	1	—	—	—
Curlew Sandpiper	—	—	—	1	1	1	3	1	—	—	—
Little Stint	—	—	—	1	3	—	4	1	1	—	—
Temminck's Stint	—	—	—	—	6	—	—	—	—	—	
Oystercatcher	101	160	237	218	102	121	64	59	29	55	63
L. Ringed Plover	—	—	—	2	1	2	1	—	—	—	—

Over 26,000 Pink-footed Geese wintered in north-west Norfolk; peak numbers were attained during January. Nesting Shelduck continue spreading inland in the Brecks and Fens.

Following two mild winters Kingfishers have become widespread. Booming Bitterns were restricted to three Broadland sites, but eight were recorded along the North coast including one at a new locality.

This River Warbler remained two weeks at Boughton Fen. Five Pallas's Warblers were recorded including this gem on Blakeney Point. Yarmouth cemeteries provided a refuge for this Little Bunting.

Northern Golden Plover (*left*) and Norfolk's first Pacific Golden Plover (*right*) which visited Thornham and Holme. Dotterel were a May-time feature including this fine example at Blakeney Point.

Pacific Golden Plover — New to Norfolk

A. M. Stoddart

A summer-plumaged American Golden Plover was reported from Holme late on 20th July 1989. It was still there the following morning until disturbed by a Marsh Harrier so that on my arrival in the early afternoon it was nowhere to be seen. It was eventually relocated at great range in Thornham harbour among Curlew, Whimbrel, Redshank, and Grey Plover. Strategic wading produced further views but these were mainly distant or in flight and not sufficient to disillusion me of the bird's supposed identity. Eventually it settled into a large creek near Thornham village and the closer, though brief, views afforded here came as something of a surprise for it showed no elongated primary extension, strikingly long legs, extremely bright and extensive gold mantle spangling, contrasting with white-spangled wing-coverts and a white flank line. This was all completely wrong for American Golden Plover — surely it had to be a Pacific Golden Plover? Views reverted to being poor for the remainder of the day, but I saw it closer the following morning on Holme wader scrapes. Any remaining uncertainties were quickly eliminated.

I was able to add further details to my notes: It was a very small, bright 'Lesser' Golden Plover, looking tiny and fragile even when standing next to a Green Sandpiper. The body was small (with no elongated rear-end of strongly projecting primaries), slim and flat-bellied when alert, but more rounded and dumpy when relaxed. The head, bill and eye were proportionally all quite large-looking. The legs were very long, the exact length of exposed tibia varying according to posture, but looking grotesquely long whenever the bird was alert or running. Close views showed that the tip of the largest tertial fell level with the tail-tip, with a short primary projection beyond, only three primary tips being visible. The bird looked tiny in flight, with narrow wings and a slim torpedo-shaped body.

It was an adult, presumably a male, in virtually full summer plumage with black underparts. The only trace of moult was some buff flecking on the lores and in the malar region. The forehead was extensively white, practically reaching the base of the culmen. This continued into a broad white supercilium and ear-covert surround and led into a moderate-sized breast-side patch and a white flank line of uniform width separating the black underparts from the folded wing. This flank line was identical on each side and inlaid with a few scattered black chevrons. The undertail-coverts were patched black-and-white. The lateral and longest undertail-coverts were white with black running down the central feathers for two-thirds of their length. Sparse white flecking was present around the vent and there was single gold feather on each flank. The upperparts were very heavily spangled with very large bright notches and tips to each feather, mainly bright golden on the mantle and scapulars, but contrastingly white on the wing-coverts. There was less spangling on the crown, nape and hindneck, making these areas slightly darker. The tertials, some of which were quite faded and worn, were blackish-brown barred whitish-buff and the primaries were dark brown. Legs were a dull greenish-grey. In flight the dusky underwings and axillaries were most striking. The upperparts in flight were uniform golden with a thin white wing-bar.

The bird remained very flighty and mobile in the Holme/Thornham harbour area for the remainder of the 22nd, but most observers who arrived that day managed to see it. It then went missing, presumed to have gone, but was finally reported briefly at Holme on 26th July. Pacific and American Golden Plovers were until recently treated as conspecific under the name of Lesser Golden Plover. Pacific Golden Plover breeds in northern Siberia and extends across the Bering Straits into western Alaska wintering around the shores of the Indian Ocean, in south-east Asia, Australasia and the Central and western Pacific Islands and a few even reach California. Such a bird would seem a prime candidate for vagrancy, but they are surprisingly rare in Britain with only six accepted previous occurrences: in Lincolnshire, Humberside (2), Lothian (2) and Shetland. The expected East Coast bias to the records so far hopefully means that Norfolk is well-placed to receive another of these supremely attractive Asian plovers. On the evidence so far, July would seem to be as likely a month as any for the next one . . .

The Barn Owls of North Norfolk

Paul. N. Johnson
Conservation Officer, The Hawk Trust

In 1988, following the results of its national Barn Owl survey, which showed that many areas throughout the United Kingdom had suffered a major decline over the past fifty years, The Hawk Trust established an intensive conservation programme in north Norfolk, intended to monitor the distribution of Barn Owls in different environments. The current study area extends from King's Lynn in the south-west, across to Aylsham in the south-east, with the A47 trunk road defining the southern boundary and north to the coast as far east as Cromer.

As conservation officer, I am currently surveying the natural distribution and density of Barn Owls within the study area, mapping the habitats supporting breeding and non-breeding pairs and promoting and carrying-out practical conservation work to secure and expand the existing population on farms and estates. The Barn Owls on a sample of estates are being monitored to study the year-round behaviour and interactions with other raptors and agricultural and game-rearing land management. With the co-operation of the National Trust, the National Centre for Owl Conservation was established in 1988 at Blickling Hall, near Aylsham, to further promote the conservation of all birds of prey including owls.

In the field, I quickly noted the broad variety of habitats, ranging from intensive arable in the north-west to coastal marsh and the historic parklands in the north-east, all supporting Barn Owl populations. When investigating the density of breeding sites throughout the study area, I soon realised the importance of large tree cavities which the birds select as breeding sites. In the north-west of the study area, Ash and Beech trees offer suitable cavities and are often located along minor roads. In the North East, the majestic stands of parkland Oaks provide abundant cavities. To date, over 80% of confirmed breeding sites are in tree cavities. These are found in trees in a state of some decay, but they are particularly prone to storms and clearance operations. Eight known breeding sites were lost in the gales early in 1990, though fortunately with the co-operation of the land-owners two were re-erected and three have been trimmed and nesting boxes mounted on the remains of each stump. Buildings may be selected as nesting sites if straw bales are still stored in them during the summer, the birds nesting amongst the bales. However several instances of disturbance have occured to incubating Barn Owls, when bales have been moved in the early summer. If nesting-boxes have been erected in quiet, dark, corners,

of old barns some birds have quickly utilised them, thus avoiding the risks of disturbance and predation throughout the year, as Barn Owls often roost in the same location. By providing nesting-boxes in trees if natural cavities are not readily available as well as in barns it will be possible to evaluate their selection over the next two breeding seasons. As the natural trend is to nest in trees, the population may select for tree-mounted boxes. Unfortunately the increasing trend to convert old agricultural buildings into holiday homes is removing the winter roost sites for many birds and possibly forcing the population into tree sites.

Mortality is an important factor in any population and is being monitored through historic records, current reports and taxidermists' diaries. In the case of Barn Owls, road traffic mortality is especially widespread and worrying. Rough grassland verges with their associated small mammal populations attract owls to the close proximity of fast moving vehicles. Most deaths recorded in the study area have been reported along the more improved sections of Norfolk's roads the A47 and A149. Interestingly birds are frequently reported drowned in water tanks, old baths and in wells, easily avoidable if the tanks are netted over or floating plastic mats are placed in the water troughs.

Indigo Bunting: An Addition to the County List

J. R. Williamson

A male Indigo Bunting was present in Wells Woods from 21st to 30th October 1988. The bird could be very skulking in brambles, but over the period of its stay it provided many hundreds of birders with excellent views of what was for the majority their first encounter with this completely unexpected vagrant from the New World. In North America it breeds in woodland clearings and abandoned farms, wintering in the West Indies and Mexico to Panama.

The amount of blue in the plumage indicated the bird to be a male. However, the debate over its age continues, leaning towards a first-winter in advanced plumage. The fact that the species has a complex and variable moult confused matters further, but this individual was apparently moulting from a brown to a blue plumage. General size was slightly larger than Redpoll, larger-billed but structurally similar appearing large-headed, short-necked and stocky, the occasionally erected crown feathers emphasised this appearance. The head, nape and upper mantle were greyish-brown interspersed blue, the latter having an iridescent sheen. Lower mantle, rump and uppertail coverts were iridescent blue and likened to 'kingfisher blue'. Tail was broad, fairly short and slightly notched, the feathers being bluish-black with bright blue outer fringes except the central pair which were apparently darker. In flight the rump and tail appeared bright blue with a darker central bar. Primary coverts and alula were fresh and crisp, bluish-black edged brighter blue. Median and greater coverts were brownish with a single wholly blue greater covert on each wing, appearing new and contrasting with the worn looking brown greater coverts. Primaries and secondaries were bluish-black, edged bright blue, and showing no signs of abrasion. Tertials were dark blue, fringed buff-brown and heavily worn. Underparts were bright blue, spotted grey-brown. At times the breast in particular appeared wholly blue. On other occasions the flanks, notably towards the vent, appeared almost wholly grey-brown. Indeed the whole plumage, particularly the underparts changed quite considerably with the intensity of light. Bill was horn-coloured, more yellow towards the base and likened in proportion to that of a Chaf-

finch. Eye was black, quite small in comparison with head size. Legs were dark, probably black. No call was heard.

The possibility of the bird being an escape cannot be dismissed although research has revealed no such indication. Ageing as a first-year greatly enhances the probability of genuine vagrancy. Pyle *et al* (*Identification Guide to North American Passerines* 1987) states that first-winter and first-summer male Indigo Buntings have brown inner primaries, primary coverts and alula. The Wells example clearly did not fit this description, all these feathers being bluish-black, fringed brighter blue and indicating adult plumage. But the variability and complexity of moult in this species and the presence of a single blue greater covert on each wing (amongst predominantly grey-brown feathers) would tend to indicate the bird was in advanced first-winter plumage. The debate will doubtless continue.

Allied to the case for genuine vagrancy are the coincidental arrivals of Cliff Swallow at South Gare Cleveland on 23rd October, Northern Waterthrush at Gibraltar Point Lincs 22nd/23rd October and Northern Mockingbird across the North Sea in Holland. Weather systems at the time indicated transatlantic crossing on strong westerlies was possible. Original landfall may of course have been to the north, the bird subsequently filtering down the East Coast. Such behaviour would be normal for birds moving down the eastern seaboard of North America.

Previous British records of Indigo Bunting all fall between August and October: Cape Clear Island an immature 9th to 20th October 1985 (accepted into Category A); Fair Isle 3rd-7th August 1964 and Walton-on-the-Naze 8th September 1973 (both the latter in Category D). Remarkably, subsequent British and Western Palearctic records could conceivably relate to birds from a multiple arrival returning north in spring having over-wintered in southern climes: Amsterdam Holland male 14th to 20th March 1989; Utsjoki Finland sex unknown 13th to 15th May 1989; Yli-Tornio Finland sex unknown May 1989 and Flamborough Head Humberside male 23rd May 1989.

Controversy over ageing and escape or vagrant issues may never be resolved. But all those fortunate enough to see the bird could not fail to be impressed by its remarkable iridescent plumage. We can at least be confident we enjoyed it, even if we shall never be sure of its origins. Thanks are due to Michael Saunt for comparison of field notes (and for finding the bird) and to Richard Millington for comments on ageing and moult; both invaluable in the preparation of this article.

This record remains subject to acceptance by British Ornithologists' Union Records Committee.

Woodlarks in Breckland

C. G. R. Bowden (RSPB)

In Norfolk and other parts of lowland Britain, large-scale planting of conifers occurred early this century on areas of heathland that would have supported species such as Stone Curlew, Nightjar, Red-backed Shrike and Woodlark. Although such species initially disappeared from the afforested areas, many, including Woodlarks have recolonised plantations after felling. The birds breed on these areas for a limited period until the young crop is well established. Thetford Forest is currently the largest area of lowland conifer plantation in Britain and covers 133,000 ha. The majority of this area is in Norfolk in a block delineated by Thetford, Brandon, Methwold, Mundford, East Wretham and Croxton. In addition there are outlying blocks near Swaffham, Didlington, Great Hockham and East Harling.

Other traditionally heathland species that occur on these young plantations of Thetford Forest include Nightjar, Whinchat, Redstart, Curlew and very large numbers of Tree Pipit. In addition, important populations of Goshawk, Long-eared Owl and Crossbill occupy the same areas at later stages in the rotation as well as the introduced Golden Pheasant.

Woodlark Population changes

Plantations of young conifers now hold over 50% of the British Woodlark population which was estimated to be 210-230 pairs in 1983. Although numbers have fluctuated widely this century, since the 1950s the trend has been downward to the lowest levels recorded. As population size has declined, so has the bird's geographical range, which formerly included most of Wales and extended as far north as southern Scotland. It is now primarily confined to five counties in South-east England. The reasons for the decline relate at least in part to the loss and fragmentation of heathland to agriculture and development, and due to habitat changes such as the invasion by self-sown pines from adjacent plantations, and increasing sward length of the grassy heaths as a result of reduced grazing pressure from declining numbers of rabbits due to myxomatosis.

On Norfolk Breckland heaths there have been no breeding records since 1983 when the last pair bred on the Stanford Training Area, following a steady decline there over the previous ten years. Numbers occuring on the heaths have been poorly recorded in the past, so how many occurred on these areas earlier this century is unclear.

Habitat requirements

Woodlarks require areas of short vegetation or bare ground (normally on light soils) for foraging, and taller vegetation for nest sites as well as something that can be used as a song post. Detailed work on Thetford Forest has shown that the areas within the territory used for feeding are those with more bare ground, short grass and moss. The proportion of these features is therefore likely to be critical. The diet comprises spiders, weevils, Lepidoptera larvae and a wide range of other small invertebrates in the breeding season, and these are gleaned from low vegetation and the soil surface. They eat mainly seeds in winter.

Woodlarks and conifer plantations

Over 20% of Breckland on the Norfolk/Suffolk border was planted with conifers after World War I, and now covers over 200 km^2. The combined effect of the uneven spread of original planting and the 50 to 60 year optimal felling period for pines, means that, according to current harvesting predictions, over 50% of the total area will have been

felled between 1980 and 2000. The increased amount of planting in the 1980s is shown in Figure 1.

This increase in the amount of new plantations has resulted in higher Woodlark numbers and these have, in contrast to the heathland population, been well documented (mainly by R. A. Hoblyn) and have increased steadily over the past 20 years (Figure 1).

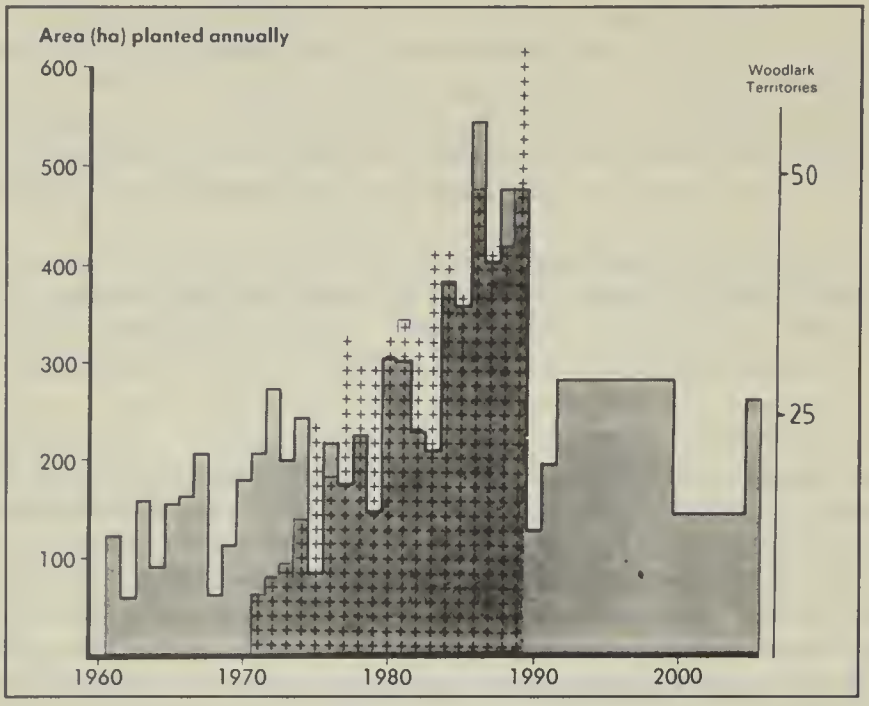


Figure 1: Area planted in each year since 1960, with current projection of future planting to 2005, and Woodlark territories since 1971 on plantations of Thetford Forest.

The increase in the forest woodlark population has largely followed the increasing area that has been planted in more recent years (Figure 1). Annual fluctuations indicate that there are other factors involved; these are likely to include variations in winter survival perhaps caused by weather. However, the wintering grounds of Thetford Forest woodlarks are unknown, the only indication we have is one sighting of a colour-ringed bird at Margate, Kent in early March, which has subsequently been seen back on the forest.

Woodlarks tend to occupy the younger plantations, those planted one and two years previously are most favoured. Once the trees are over three years old, woodlarks usually vacate the area, moving on to areas planted more recently (Figure 2). Exceptionally they have occupied areas for longer where rabbit grazing has been heavy and the density of young pines low. The reason why Woodlarks occupy these age-classes are related to the proportions of bare ground, short grass and other categories of short vegetation that have been found to be the important features of feeding areas.

There are two important features to note from this; the dependence of the Woodlarks on young plantations for a relatively short period of the rotation; and that the current forecasts for markedly reduced felling programmes from the year 2000. Without some action being taken, this will mean a significant decrease in the amount of available habitat at times and a consequent reduction in Woodlark numbers.

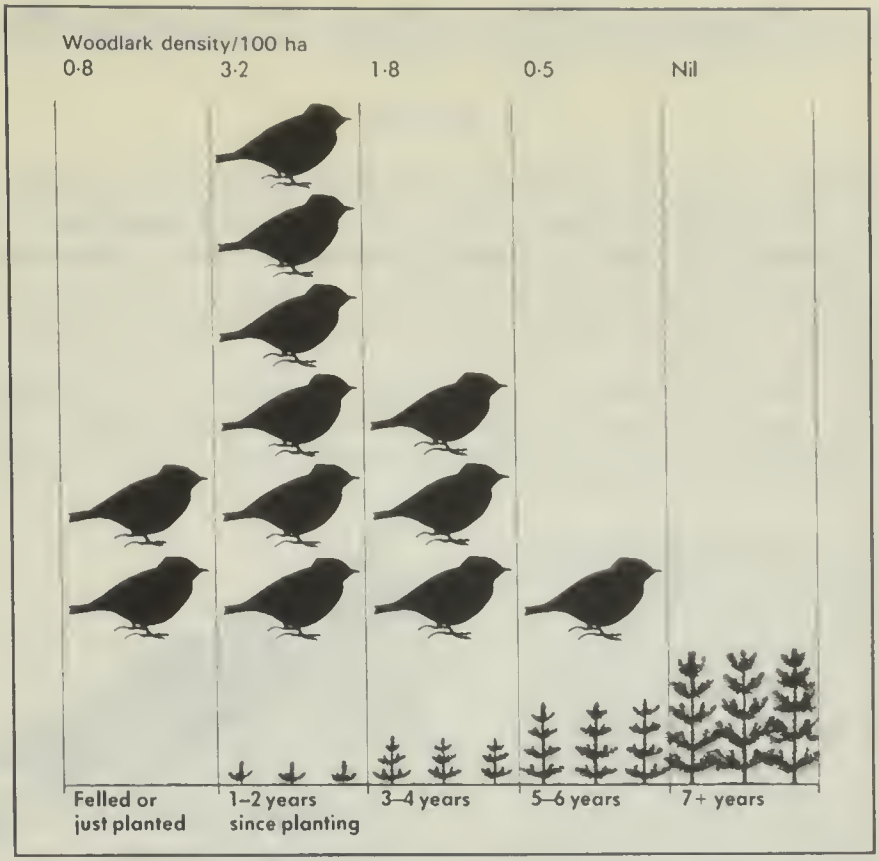


Figure 2: Densities of Woodlarks found in each age-class of plantation in Thetford Forest (reproduced with permission from RSPB *Conservation Review*).

One way to alleviate the problem is to achieve a more equal spread of planting within the forest. Another would be to leave some areas unplanted and managed specifically for Woodlarks. Both would involve some loss of revenue to the Forestry Commission but are currently under consideration, and indeed on the East Suffolk forests where the balance is far less even following the massive wind-blow in 1987, these measures have been agreed to, with Woodlarks in mind. A third option to maintain the population through the 'bottleneck' periods is to maintain the suitability of plantations for one or two extra years by managing the ground vegetation between the young trees. Ground disturbance and herbicide trials are currently in progress in an attempt to achieve this. It is hoped that results from this work will be equally applicable to heathland as well as forestry areas so that this very important population of Woodlarks will continue to thrive in the Brecks.

Acknowledgements: The study is funded by the Forestry Commission with support from RSPB. I thank everyone who has contributed records, but I am particularly grateful to Rhys Green and Ron Hoblyn.

References

Bowden, C. G. R. in press. Selection of foraging habitats by woodlarks (*Lullula arborea*) nesting in pine plantations. *J. Appl. Ecol. 27.* Bowden, C. G. R. & Hoblyn, R. A. in press. The Increasing Importance of Restocked Conifer Plantations for Woodlarks in Britain: implications and consequences. *RSPB Cons. Rev. 4.* Cramp, S. (Ed.) 1988 *Handbook of the birds of Europe, the Middle East and North Africa*, vol. 5. Oxford University Press, Oxford. Sitters, H. P. 1986 Woodlarks in Britain, 1968-83. *Brit. Birds* 79:105-116.

RSPB Conservation Review is available from RSPB, The Lodge, Sandy, Beds, SG19 2DL.

Yellow-browed Bunting: First for Britain

J. B. Kemp

October 1975 was a vintage month for Siberian vagrants at a time when far fewer observers were actively seeking migrants than nowadays. The wind had veered north-easterly on the 9th as an anticyclone became established over the Baltic. This weather system remained for most of the month and the associated easterly airstream across the whole of central Europe resulted in a most exciting period in the annals of local ornithology.

Holkham woods scored heavily in this period 'providing the best ever mainland rarity watching'. The wave of eastern birds included Dusky Warbler, 2 Radde's Warblers, 2 Pallas's Warblers (they were still major rarities), Black-throated Thrush and the county's first Olive-backed Pipit and Isabelline Shrike.

During the late afternoon of October 19th M. Parker located what he believed at the time to be a Rustic Bunting in a scrubby area near the caravan site. He found D. J. Holman and myself nearby and together we soon re-located what was clearly a very unusual bunting. Fortunately the views over a period of half-an-hour were very good and at times within ten feet. The bird's most striking feature was its bold head pattern showing a white central crown stripe bordered black with yellow on the supercilium between the bill and eye. Rather smaller than a Reed Bunting, it gave a classic bunting *tick* call rather resembling a Robin at a distance. It was very much in the Little/Rustic Bunting mould showing whitish underparts with black breast streaking and sub-moustachial stripe, warm brown ear-coverts with a small white spot and narrow white double wing-bar formed by pale tips to greater coverts and median coverts. The question was identity. Rustic Bunting was eliminated on several points especially a lack of rufous flank streaking, but it was only after examining a selection of skins at the Castle Museum Norwich that we felt confident that our bird was a Yellow-browed Bunting.

The record was accepted by *British Birds Rarities Committee* and published in their *Rare Birds in Great Britain 1975* report in *British Birds* (1976) Vol 69: 358. The delay by the BOURC to accept the record until very recently revolved round several factors including 'loss of paperwork' and 'discrepancies between descriptions'. Fortunately a Fair Isle record of 1980 added enormously to our knowledge of the identification of this species and is I believe partly responsible for the full acceptance of the Holkham bird. Further details of the Norfolk occurrence will appear in *British Birds.* A comprehensive account of the Fair Isle individual (which closely resembled the Holkham bird) may be found in *British Birds* Vol 76: 217-225.

Very little is known about the Yellow-browed Bunting. Apparently only a single nest has been described. Shrub thickets and taiga forest are inhabited. It is almost certainly the most easterly distributed passerine to have occurred in this country. The wintering area is in eastern China.

A Knot Catch to Remember

P. L. Ireland

The Wash Wader Ringing Group celebrated its thirtieth anniversary in 1989. In the early years much of the group's work was driven by the threat of the Wash water storage proposals, but since the mid-1970's action has focused on assessing the importance of the Wash for waders throughout the year. In the last three decades the group has done much to clarify the importance of the area to the vast flocks of waders which occur in the autumn, winter and spring (see 'The Wash — Mecca for Waders' *Norfolk Bird and Mammal Report* 1987). However, there remain many questions to be answered about the waders of the Wash. Knot is one of the species for which the area is especially important. The group were fortunate to make a large catch of Knot at Holme on October 15th. This article tells the story and puts the catch into context.

It was a bright moonlit night when the team rose at 3 a.m. to set nets on the outer spit and to be in a camouflaged hide two hours before the dawn high tide. The early start was well worthwhile when in the first light and silhouetted against the full moon great swirling flocks of Knot began to arrive. As the tide rose, pushing the birds ever closer, and as it became fully light it was apparent this was an exceptionally large flock of Knot. And still more arrived, the newcomers squeezing into the seething mass already on the ground. By high tide there was a carpet of birds, nearly all Knot, stretching from the outer end of the spit to within a few metres of the hide.

This number of birds gave a problem as, in addition to attempting to make a catch, the group had volunteered to do the official count and how does one count such a vast flock? Fortunately several of the group's most experienced wader counters were in the hide, but even they decided it would be difficult to use normal methods to assess a flock of this size. To begin with the odd Oystercatchers dispersed through the flock were used to split the birds into small sections and then an estimate was made of the number of Knot in each section. Adding all the sections together gave a total of between 90,000 and 100,000 birds. Seeing how tightly packed they were with each almost touching its neighbours it was felt this could be a conservative estimate. Hence a second method of counting was attempted. This was to work-out the average number of birds per square metre at high tide and then to multiply this by the area covered by the flock. Estimates of the density of Knot in various parts of the flock were made and these varied from 50 per square metre to over 150. The area completely covered by Knot at high tide was later measured and found to be 170 metres by 10 metres (1700 square metres) so even the lowest density gives an estimate of 85,000 birds being present. That is about a quarter of the Greenland/Canadian breeding population, the population from which the birds would have originated!

One doesn't lightly come up with counts which double previous highest counts for a site, but no one who was in the hide on that occasion is ever likely to forget the sight and size of that flock. One striking feature was that although densely packed the birds were constantly on the move swarming backwards and forwards as small waves moved them on the edge of the flock.

If there were 90,000 Knot at Holme, how many were in the whole Wash? The Birds of Estuaries Enquiry counts show there were a further 45,000 at Gibraltar Point, 5,000 at Snettisham and including a variety of other sites a grand total of 157,000 Knot using the Wash in October 1989. At the time of the November counts the total number of Knot

Publication of this feature has been subsidised by a donation from Mr. Jason Partner

in the Wash had dropped to 82,500 although it seems most of the East coast flock had still been present earlier in the month as 80,000 were counted at Snettisham. The large numbers in October followed by a decline from November onwards is typical as birds which have moulted on the Wash move on.

Returning to the catching attempt on October 15th, the sheer number of Knot present and the need to get an accurate count prevented any attempt to catch until the tide started receeding. As sand became uncovered some birds moved away and this gave a brief opportunity to catch what seemed a minute proportion of the birds that had a few minutes earlier been present. The initial impression on reaching the fired net was that only a few hundred had been caught but the birds were so tightly packed that it soon became apparent that it was a large catch. When all the paperwork had been done and the totals added-up the catch was found to be 1,478 Knot and just 2 Oystercatchers. This total would mean that one in 60 of the Knot estimated to have been present at high tide had been caught; a much higher proportion than anyone felt possible. This evidence reinforces the belief that the estimate of 90,000 was low and the real total may well have been in excess of 100,000.

What did we learn from 1,478 Knot? Taking measurements on a small sample revealed a mean wing length of 171 mm and a mean bill length of 33.2 mm which fall in the range expected for the Greenland/Canadian breeding population and confirming the origin of the birds. The mean weight was 134 gm which is the normal for Knot in the early autumn before they gain weight to take them through the winter. The state of moult of the primary feathers was recorded on the same sample and revealed that the majority were still in active wing moult. Only one in every 35 of the birds caught were birds-of-the-year giving an indication of a poor breeding season in 1989. This contrasts with the previous year's good breeding season when a third of the Knot would have been birds-of-the-year. It is likely that the reason for the large flocks of Knot in the autumn of 1989 is that many of the 1988 young have survived although it was not possible to prove this from the birds caught as it is not possible to determine second-year birds from older ones.

Of the birds caught 6% already wore rings from previous captures. Details of foreign-ringed birds take some time to become available so at the time of writing it is only possible to record that Knot were already wearing rings from Germany (4 birds), France (2), Iceland (2) and Norway (2). As indicated above, counts have shown that birds move away from the Wash after completion of moult in October. What the counts do not show is where the birds go. Among the recoveries were ten Knot originally ringed elsewhere in Britain at Teesmouth, Mersey, Ribble, Solway, Firth of Forth, Moray Firth and Dornoch Firth. All were ringed during the winter or spring and clearly indicate, perhaps surprisingly, that many of the Knot using the Wash to moult are at estuaries further north later in the winter. Of the 68 birds caught which were originally ringed at the Wash, nearly half were over ten years old and the oldest was ringed in 1968, making it at least 21, confirming the longevity of waders and Knot in particular.

This day will be remembered for many years to come by all those present for the sheer spectacle of the number of birds present and as an occasion which has also added substantially to the understanding of the importance of the Wash for Knot.

Ringing Report

Allan Hale

During 1989 over 21,000 birds of 121 species were ringed in Norfolk. This is more than in any previous year and included 1,950 Dunlin, 1,200 Blackbirds, 440 Blackcaps, 2,736 Greenfinches and 173 Siskin. Interestingly the Sparrowhawk total was greater than that of the Kestrel. Amongst the less commonly ringed species were Curlew Sandpiper, Jack Snipe, Pallas's Warbler and Red-backed Shrike. Again the embarrassment of recoveries has resulted in many records being omitted because of lack of space.

Normally a recovery illustrates but two points in time in the life of a bird. This year however there are an encouraging number of 'multiple recoveries' demonstrating unusually complete life histories. Also included are no less than four individuals trapped at the same French ringing site.

The format of the ringing recovery section does, as usual, use the codes developed by the organisation of European ringing schemes. The interpretation of these codes is as follows:

Age when ringed:	1 pullus (= nestling or chick)
	2 fully grown, year of hatching quite unknown
	3 hatched during calendar year of ringing
	4 hatched before year of ringing, exact year unknown
	5 hatched during previous year
	6 hatched before previous year, exact year unknown
Sex:	m = male; f = female
Manner of recovery:	v caught or trapped, released with ring
	vv ring number read in field
	vB breeding where recaptured

+	shot or killed by man
x	found dead
xF	found freshly dead
xL	found long dead
( )	caught alive but not released
?	manner of recovery unknown

Thanks are extended to all Norfolk ringers from whose data this report has been extracted. Thanks also to Steve and Alison Wakeham for the Wash Wader Ringing Group recoveries and their interpretation.

NORFOLK RECOVERIES NOTIFIED IN 1989

Great Crested Grebe: The first foreign recovery from British ringing, although it should be noted that very few Great Crested Grebes are ringed.

3	2.9.88	Pensthorpe, Fakenham
xL	16.1.89	Calais, France. 218 km SSE

Shag: There is no precedent for two Shag recoveries in Norfolk within such a short period of time.

1	13.6.87	Craigleith, Lothian, Scotland
x	6.6.88	Sandringham. 420 km SSE
1	25.6.87	Isle of May, Fife, Scotland
x	2.4.88	Methwold Hythe. 454 km SSE

Spoonbill: Vlieland is the next to most south-westerly of the West Fresian Islands and the Spoonbill colony there is of recent origin.

1	11.6.86	Bomenland, Vlieland, Netherlands
vv	28.4.88	Cley-next-the-Sea. 270 km W

Bewick's Swan: A post-mortem revealed the cause of death as lead poisoning. From 8.12.71 until 9.12.73 this bird was always sighted in the company of its mate, named 'Ace' (who was found dead at Lake Vepshozero, Karelia, U.S.S.R. on 11.11.76). A fascinating series of sightings for both birds; it is unusual that life histories are so complete.

4f	8.2.71	Slimbridge, Gloucester (named 'Spades' and stayed until 24.1.72)
vv	20.11.72	Slimbridge (until 11.1.73)
vv	13.1.73	Welney (until 13.2.73)
vv	9.12.73	Slimbridge (with one cygnet)
vv	20.2.76	Sirjansland, Zeeland, Netherlands
vv	8.4.78	Elbe Estuary, West Germany
x	7.1.89	Filby Broad

Shelduck: The Wash is an increasingly important moulting area for Shelduck.

1	8.7.89	North Creake, Fakenham.
x	28.8.89	Terrington Marsh. 35 km WSW.

Teal: A remarkable coincidence that both birds were shot in Finland on the same day!

5m	29.1.85	Pensthorpe, Fakenham
+	20.8.89	Kronoby, Vaasa, Finland. 1,766 km NE
4m	22.11.88	Pensthorpe, Fakenham
+	20.8.89	Haukipudas, Oulu, Finland. 1,944 km NE

Pintail: The first Russian Pintail recovery to result from Norfolk ringing.

4f	21.9.87	Pensthorpe, Fakenham
+	15.5.89	Shomoksha, Arkangelisk, U.S.S.R. 2,515 km ENE

Pochard:

6m	11.1.89	Pensthorpe, Fakenham
+	19.8.89	Kreba, Dresden, East Germany. 956 km E

Oystercatcher: The 13th movement from The Wash to The Faeroes.

6	28.3.82	Terrington, King's Lynn
x	1.8.89	Koltur, Faeroes, 1,108 km NNW

Golden Plover: Only the second British-ringed Golden Plover to be reported from Holland.

4	13.8.87	North Wootton, King's Lynn
v	18.3.89	Friesland, Netherlands. 338 km E

Knot: Two birds, caught together in West Germany, and again together at Holme.

6	22.4.86	Foehr, Nord Inseln, West Germany
v	8.11.87	Holme-next-the-Sea. 553 km WSW
6	22.4.86	Foehr, Nord Inseln, West Germany
v	8.11.87	Holme-next-the-Sea, 553 km WSW

Curlew Sandpiper: This bird increased its body weight from 63.0 g to 72.5 g during the 11 day period, suggesting that it had been on The Wash for several days prior to its recapture. It represents only the second Swedish-ringed Curlew Sandpiper to be found in Britain.

3f	20.8.88	Nidingen, Halland, Sweden
v	31.8.88	Terrington, King's Lynn. 890 km SW

Dunlin: The selected recoveries show the 5th Wash bird from France, the 8th and 9th from the French ringing effort in Mauretania, the 5th from north of the Arctic Circle and a rapid movement from Norway.

4f	16.4.85	Charente-maritime, France
v	30.7.88	Terrington, King's Lynn. 773 km N
6	16.4.85	Baie du Levrier, Mauretania
v	31.7.88	Terrington, King's Lynn. 3,933 km NNE
5	12.4.86	Baie du Levrier, Mauretania
v	1.8.88	Terrington, King's Lynn. 3,933 km NNE
3	22.8.88	Farsund, Vest-agder, Norway
v	28.8.88	Terrington, King's Lynn. 711 km SSW
3	16.9.78	Wolferton, King's Lynn
v	27.6.89	Gamvik, Finnmark, Norway. 2,460 km NE

Bar-tailed Godwit: The 7th movement from The Wash to the U.S.S.R. and the 5th to this particular region.

6m	22.8.74	Wolferton, King's Lynn
+	17.5.88	Arkangelsk, U.S.S.R. 2,808 km ENE

Redshank: A traveller along the regular flyway to Iceland and a bird from Holland not necessarily attaining its apparent age ('ringed leg only' found).

4	24.10.76	Snettisham, King's Lynn
v	17.5.89	Nordur Thingeyjar, Iceland. 1,766 km NW
2	5.8.74	Kroonspolders, Vlieland, Netherlands
xL	15.3.88	Hunstanton

Turnstone: The first British-ringed Turnstone to be found in The Gambia. Reported as (direct translation): 'Alive on ship, found sleeping in canoe'!

6	3.8.77	Terrington, King's Lynn
v	19.10.89	Sarra Kunda, Gambia. 4,584 km SSW

Black-headed Gull: Winter-ringed birds in Norfolk were reported from The Netherlands (4), Denmark (6), Finland (2) and Poland. There were further reports resulting from the nestling ringing at Cantley from Glamorgan, Dorset, Cornwall, Nottinghamshire and Yorkshire. The selected recoveries show an unusual Norfolk 'resident' and an example of site fidelity during successive winters.

5	12.1.85	Thorpe St. Andrew, Norwich
x	20.6.89	Hickling Broad. 18 km NW
1	27.6.87	Jarvenpaa, Uusimaa, Finland
v	22.1.89	The Mere, Diss. 1,721 km WSW
v	29.1.89	The Mere, Diss
v	26.12.89	The Mere, Diss

Common Gull: The ring was found in an Eagle Own nest!

5	19.1.85	Norwich
x	3.8.89	Holmavatn, Rogaland, Norway. 772 km NNE

Guillemot: It is difficult to believe that the bird was in good condition when captured, but note distance travelled and time taken.

4	30.3.89	Den Helder, Noord-Holland, Netherlands
xF	8.4.89	Great Yarmouth. 206 km W

Barn Owl: This is the longest movement from Norfolk ringing. There were an additional four recoveries during 1989, the furthest travelled being 32 km.

1	26.6.88	North Norfolk
x	25.12.88	M11 near Harlow, Essex. 143 km SSW

Tawny Owl: Note age reached which was extremely close to a new British longevity record.

4	9.7.70	Rackheath, Norwich
x	11.7.89	Norwich. 6 km SW

Swift: Note the unusually late recovery date.

4	28.6.81	Rockland, Norwich
x	12.10.89	Thurton, Norwich. 2 km SSW

Sand Martin: There have been numerous movements from Norfolk to Llangorse over the years. In addition to the published recoveries there were four movements between Haddiscoe and Icklesham (Sussex) and another between Sedgeford and Icklesham (the Sand Martin passage ringing effort there is intense). Note that Haddiscoe, Icklesham and the two French sites are almost exactly in a straight line.

3	1.8.85	Llangorse, Powys, Wales (at roost)
vB	12.7.87	Loddon. 337 km E
vB	18.7.89	Haddiscoe, Beccles
3	9.7.89	Haddiscoe, Beccles
v	30.7.89	Nevoy, Loiret, France. 536 km S
3	27.8.87	St-Seurin-d'Uzet, France
v	4.8.88	Haddiscoe, Beccles. 798 km NNE
3	9.7.89	Haddiscoe, Beccles
v	30.8.89	St-Seurin-d'Uzet, France. 798 km SSW

Pied Wagtail: The distance travelled by this bird is equivalent to the distance between Norwich and north-west Switzerland.

3	27.10.88	Earlham, Norwich
x	1.5.89	Cromarty, Scotland. 652 km NNW

Robin: These reports show where some of our autumn migrants spend the summer, and give an indication of the route taken to get there.

2	21.10.88	Holme Bird Observatory
x	20.4.89	Sanderbusch, Weser-Ems, West Germany
3	6.10.87	Weybourne
x	22.6.88	Vatn-Vatnet, Nordland, Norway. 1,760 km NNE

Redstart: Having arrived safely in Holland it seems strange that this bird then chose to cross the North Sea.

3m	14.9.88	Kroonspolders, Vlieland, Netherlands
x	22.9.88	Colby, North Walsham. 250 km WSW

Blackbird: Foreign recoveries were from Sweden (3), Norway, West Germany and The Netherlands, plus two from Wales. The movement published in full demonstrates the date of return passage north-eastwards.

3f	12.11.88	Norwich
v	21.3.89	Helgoland, West Germany. 474 km ENE

Fieldfare: An autumn migrant moving through Norfolk on its way to winter in France.

4f	3.11.88	Weybourne
x	18.12.88	Ribagnac, Dordogne, France, 911 km S

Sedge Warbler: Remarkably two Norfolk Sand Martins were involved in movements to the same French location as these two Sedge Warblers.

4	1.5.88	South Lopham, Diss
v	2.8.89	St-Seurin-d'Uzet, France. 775 km S
3f	1.8.88	St-Seurin-d'Uzet, France
v	10.6.89	Earlham, Norwich. 807 km N

Reed Warbler: Only the second British record from Guinea Bissau. Strangely the first was ringed at the same place (and on the same day) and was subsequently recovered in Glamorgan during 1987. Other Norfolk Reed Warblers were recovered in Belgium and France. The September Cantley bird would not have been expected to turn up in France in mid-June.

5	2.2.87	Ilha das Areias, Fulacunda, Guinea Bissau
x	21.7.88	Cley-next-the-Sea. 4,822 km NNE
3	19.9.86	Cantley
v	17.6.89	Marais du Quellen, France. 553 km SW

Blackcap: Was this bird a failed breeder, making its way prematurely southward?

5m	27.5.84	Helgoland, West Germany
v	28.7.87	Burnham Market. 492 km WSW

Chiffchaff: An incredible series of retraps. This is the first time a Chiffchaff has been shown to both winter and breed in Britain, and remarkable in that it wintered and bred at the same locality — effectively Britains first ever resident Chiffchaff!

2	12.11.88	Weybourne
v	3.12.88	Weybourne
v	18.3.89	Weybourne
vB	2.6.89	Weybourne
v	13.9.89	Weybourne

Starling: This shows a bird spending successive winters either side of the North Sea. Other wintering birds in Norfolk came from, or went to, The Netherlands, East Germany and Sweden.

5m	1.1.87	Mierlo-Hout, Noord Brabant, Netherlands
v	23.1.88	Norwich. 325 km WNW

Golden Oriole: A nestling ringed on 17.6.88 was found dead on 28.9.89, 11 km SE of its natal wood. This is the first recovery resulting from the Golden Oriole breeding population in Britain.

Greenfinch: The Norwegian bird represents only the second movement between Norfolk and that country. Indeed during the last 30 years there have only been 10 international Greenfinch movements concerning Norfolk. All movements in excess of 100 km have been detailed; there were an additional 10 of between 50 km and 100 km. Additionally there were two local recoveries interesting in that the rings were found in Hen Harrier pellets at Roydon Common.

6m	10.4.88	Bryneheia, Vest-Agder, Norway
v	23.10.88	Ormesby St Margaret. 681 km SSW
5m	13.4.89	East Winch
x	10.5.89	Driffield, North Yorkshire. 169 km NNW
5f	15.1.84	Wellington, Shropshire
x	20.12.88	Elsing, Dereham. 243 km E
3f	24.10.87	Weybourne
x	11.5.89	Warboys, Cambridgeshire. 101 km SW
6f	5.3.89	Great Missenden, Buckinghamshire
x	28.5.89	Mundham, Loddon. 172 km ENE

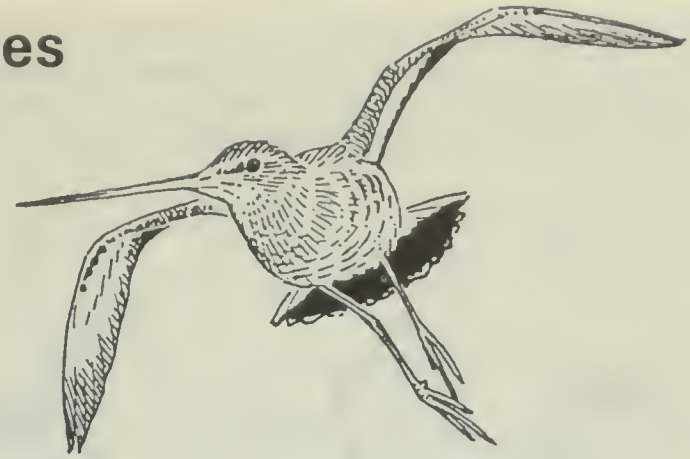
Goldfinch: Ringing has shown that large numbers of British breeding Goldfinches move to and from winter quarters in Iberia via the Low Countries.

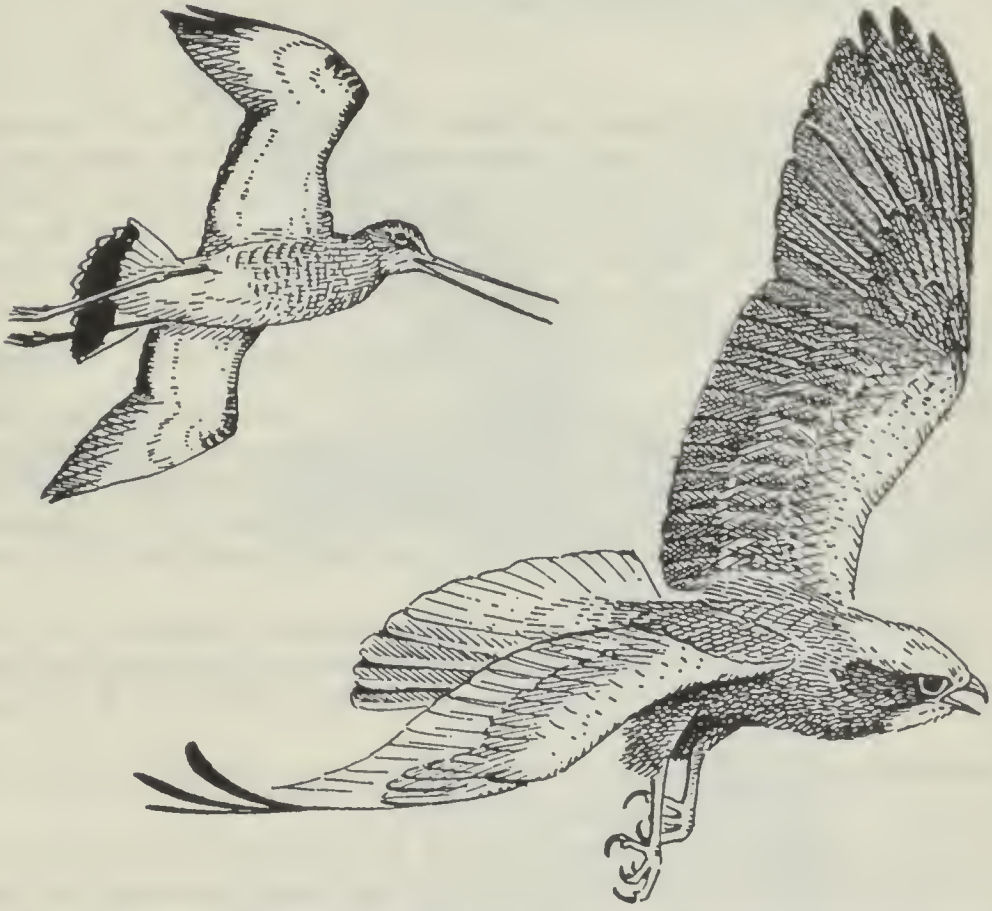
4f	19.4.88	Leper, West-Vlaanderen, Belgium
v	30.4.88	Weybourne. 260 km NW
5m	23.4.88	Weybourne
v	21.4.89	Middelkerke, West-Vlaanderen, Belgium. 225 km SSE

Siskin: There were unprecedented numbers of Siskin feeding in gardens throughout much of Norfolk during March 1989.

3f	24.9.88	Clochan, Buckie, Grampian, Scotland
v	11.3.89	Beechamwell, Swaffham. 602 km SSE
6m	16.3.87	Bridgnorth, Shropshire
v	5.3.89	Thetford. 211 km E
5m	29.3.88	Stirling, Central Region, Scotland
v	18.3.89	Thetford. 523 km SE

Classified Notes



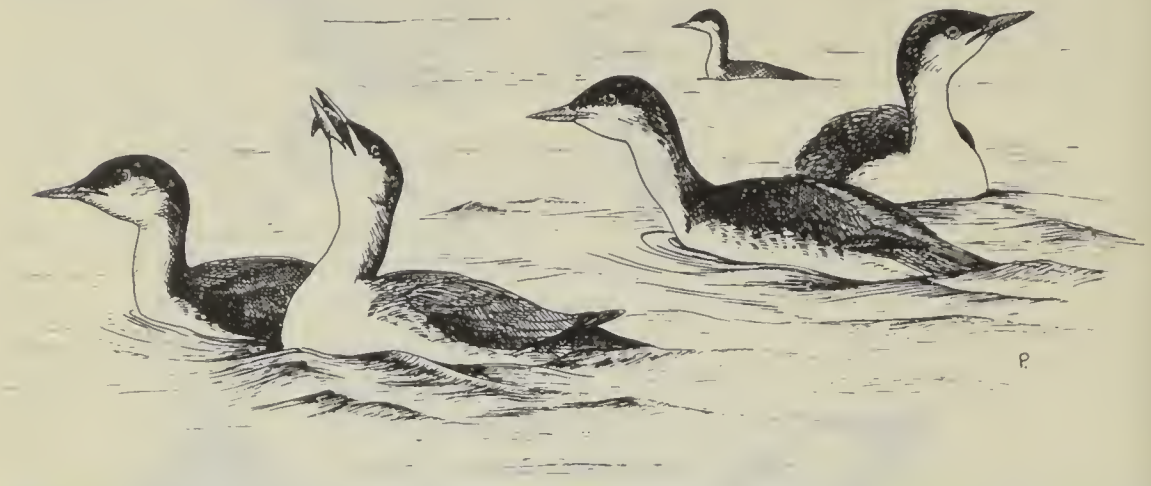


These notes are based on *Birds of Norfolk* (1977 revised edition) where information regarding status, distribution, migration and ringing recoveries may be found. Attention is drawn to migration observations appearing in the bulletins of Cley Bird Club and also featuring in NOAs Annual Report. In addition NARVOS Report for 1989 contains great detail regarding distribution in west Norfolk.

The order used is that of K. H. Voous (1977) List of Recent Holarctic Bird Species. Observations refer to 1989, unless otherwise stated. To save space, all but the most essential initials have been omitted. Records are of single birds unless otherwise stated.

Red-throated Diver: Coastal records until May 14th and from Aug 22nd. Rather scarce for the second consecutive year and consequently peak counts low: 100 Cley Jan 21st, 77 Cromer Feb 12th and 80 east Sheringham Nov 19th.

Inland: Downham Market Relief Channel (oiled) Jan 14th-Feb 8th and Breydon Dec 23rd-31st.



Black-throated Diver: Seventeen reports until March 19th; mainly singles but 3 Hunstanton Jan 18th and 3 Salthouse March 5th. Also one Ouse Mouth May 18th. The heaviest autumn passage ever recorded in the county commenced with a summer-plumaged adult Cley Sept 17th-18th. Then almost daily reports Oct 6th-Nov 29th including 10 Holkham Bay Oct 22nd, 4 Holme Nov 1st and 4-7 daily between Sheringham-Blakeney Point Nov 1st-12th. Few winter records however; singles on only 5 dates in Dec. Of the 92 reports in total 9 from The Wash, 74 North Coast (Holme to Cromer) and 9 East Coast (Paston to Yarmouth).

Great Northern Diver: Eight singles reported Jan 1st-March 22nd with a first-year bird Paston June 4th. Much larger numbers than ever before recorded in autumn/winter particularly between Cromer and Blakeney Point where singles on scattered dates in Oct from 4th, *daily* sightings of 1-3 birds Nov 1st-Dec 31st and 6 off Sheringham Nov 9th. Elsewhere up to 4 Holkham Bay Nov 4th-19th, singles reported on 7 dates Hunstanton to Titchwell and one Paston Nov 15th.

Little Grebe: Notable breeding concentrations: 20 pairs Holkham NNR and 12+ pairs Breydon/Berney. Largest winter gatherings: 24 Snettisham Pits Dec 2nd and 22 Burnham Overy harbour Dec 8th. Migrants on the sea: Cromer Nov 4th, Cley (5) and Weybourne Nov 12th.

Great Crested Grebe: Largest gatherings: 42 Breydon in Aug, 50 Holme Oct 18th, 70 Holkham Bay Nov 6th and 58 Snettisham Nov 12th.

Red-necked Grebe: Apart from 3 Hunstanton Jan 1st, 26 coastal reports of 1-2 birds until April 18th with one Blakeney Point May 16th. 59 coastal reports from Aug 9th (Aug 3, Sept 12, Oct 18, Nov 22 and Dec 4) including 4 Holme Sept 14th, 4 west Sheringham Nov 9th and 5 Holkham Bay Nov 19th. Inland: Pentney GP Jan 15th-20th and Sept 18th/19th and Strumpshaw Nov 25th.

Slavonian Grebe: Observations in early part of year involved small numbers wintering on The Wash although singles Holkham Bay Jan 1st and Cley Jan 8th and 28 reports of 1-6 birds between Heacham and Titchwell until March 29th. Also one Holme/Thornham Point May 2nd-7th.

Autumn records from Sept 9th with almost daily coastal reports throughout Oct-Dec.

The usual build-up in Holkham Bay began with 4 Oct 10th, peaked at 20 Nov 5th-12th with 9 still present Dec 17th but no reports thereafter. Other notable counts 5 Holme Oct 25th, 10 west Cley Nov 9th and 5 Blakeney Point Nov 12th. One south Yarmouth Oct 29th was the only coastal report away from The Wash and North coast. Inland: Horsey Mere Jan 2nd-6th and Horning Jan 5th-Feb 10th.

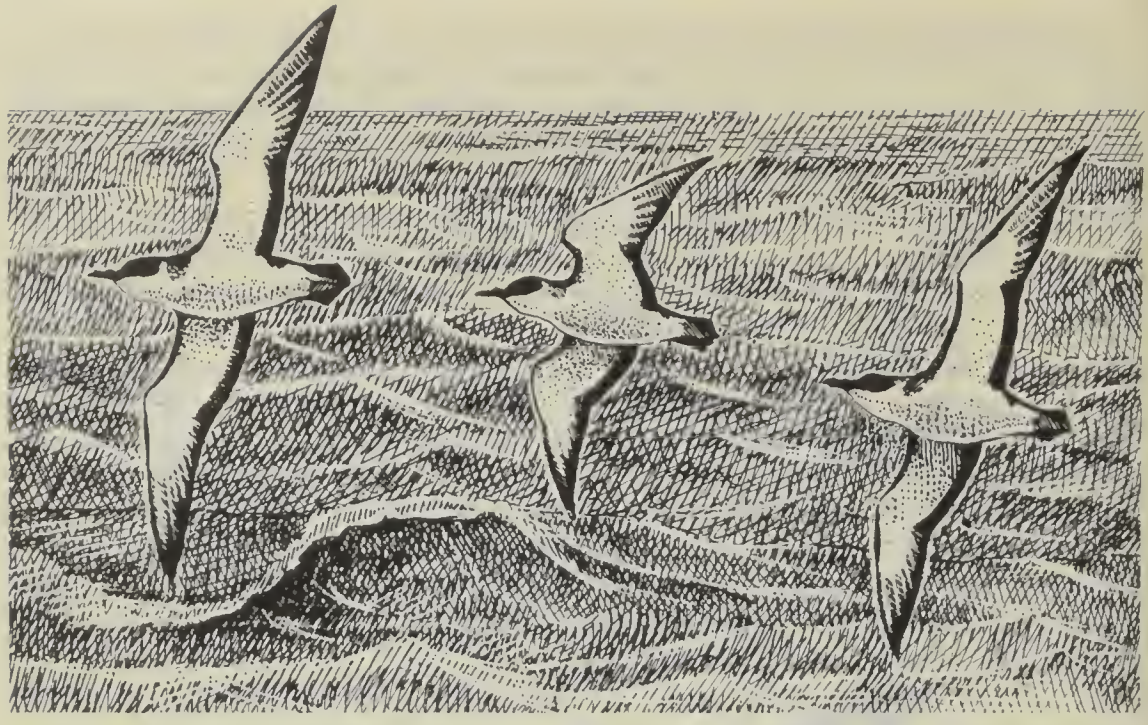
Black-necked Grebe: Brancaster harbour Feb 15th (JB), Tottenhill GP May 9th-20th (CD *et al*), 3 Thornham Point June 9th (MLW), Cley Sept 16th (MDR), Pentney GP Sept 22nd-27th (AC *et al*), Holkham Bay Nov 5th-16th (JBK *et al*), Blakeney Point Nov 12th (AMS) and Holme Dec 16th (WJAB GFH).

Fulmar: Further increases in numbers of chicks fledged at regularly monitored sites indicate a continued expansion of the county breeding population: 48 chicks fledged Weybourne-Sheringham (KBS) and 68 fledged Hunstanton (CS). Largest passages 1,800 east Sheringham Sept 9th and 600 east Cley Sept 19th. Single blue-phase birds at Cley Sept 9th and 19th, Cromer Sept 10th and Sheringham Oct 8th. Inland: Taverham June 21st.

Cory's Shearwater: A remarkable series of occurrences at Sheringham where one east Aug 27th (KBS *et al*), 2 west together Aug 28th (KBS *et al*), one east Sept 11th (RGC) and another east Oct 8th (LTH KBS). The first was also observed passing Weybourne Camp a few minutes earlier (MPT JW).

Sooty Shearwater: Three east at Holme on the very early date of July 9th (CD MTE). Main autumn passage July 30th-Oct 14th when birds recorded passing on 25 dates, the largest numbers off Sheringham: 9 Sept 8th, 15 Sept 9th and 33 Oct 8th when 22 off Paston. A very late bird Hunstanton and Blakeney Point Dec 30th (AB PJH AMS).

Manx Shearwater: A better than average showing with regular spring, summer and autumn movements May 7th to Oct 30th and very late birds at Sheringham (4) Nov 22nd Sheringham-Paston Nov 23rd. Largest movement ever witnessed in the county took place



Aug 27th (when strong northerlies) with 640 Hunstanton, 1,200+ east Cley, 880 east Sheringham and 265 east Paston. Other notable passages 102 east Cromer July 30th, 350 Cromer-Cley Aug 25th, 300 Ouse Mouth and 250 Sheringham Sept 9th and 106 Holme Oct 8th.

Additional 1988 record: Breydon Sept 4th (PRA).

Yelkouan Shearwater: Singles passed Cley Aug 6th (CL), Sept 8th (JDG PAG) and Nov 22nd (RM) and Sheringham Aug 27th (KBS *et al*).

Storm Petrel: Sheringham west Oct 8th (LTH KBS *et al*). A remarkable series of occurrences during a very severe SW gale Oct 29th when birds recorded at Holkham Bay, Blakeney Point, Cley (2), West Runton and Cromer (4).

Leach's Petrel: The exceptional passage of this petrel, the largest ever recorded in the county, was one of the main autumn events. Observations were made all along the coast from Yarmouth to Ousemouth, although the majority came from the well-watched traditional seawatching points between Blakeney Point and Cromer. Birds were recorded on the following dates (singles unless otherwise stated when site with maximum count given): Aug 25th, 26th, 27th (6 Sheringham) and 28th, Sept 2nd (5 Cley), 3rd (4 Cley), 8th (6 Cley) 9th (75 Sheringham) 10th (14 Sheringham), 11th, 12th (2 Titchwell), 28th (5 Sheringham) 29th and 30th, Oct 2nd, 7th, 8th (5 Sheringham) and 10th and Nov 22nd.

The amazing 75 (to the east) off Sheringham Sept 9th during NE gale appears to be the highest count of this species made in the North Sea.

Gannet: Peak passages 1,500 east Holme and 2,000 east Blakeney Point Aug 27th, 1,500 east Blakeney Point Sept 9th and 520 east Sheringham Sept 28th. Inland: East Tuddenham sub-adult trailing fishing line Sept 9th.

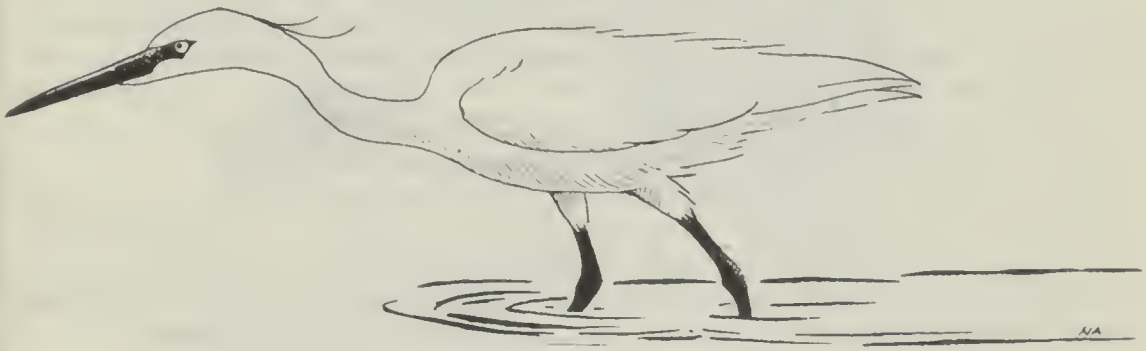
Cormorant: Bred successfully in the county for the first time since 1916 when a pair raised young at Black Dyke near Feltwell; 3 pairs nested at Narford and 3 young fledged.

Largest gatherings 320 Ranworth Jan, 165 Welney (on power lines) March, 180 Breydon Sept and 214 Holkham Park Oct. Additional roost-sites: Thornham Point, Gore Point and Seamere.

Shag: Recorded regularly only at Heacham/Hunstanton where 1-4 Jan 1st-March 19th, Wells harbour where 4 early Jan with one till March 17th and Sheringham where 3-4 present and roosting on cliffs and groyne markers Sept 7th-Dec 31st. Otherwise scattered reports of singles from many coastal sites. Unseasonal records at Holme June 16th and Paston July 30th. Inland at Brundall Sept 26th and Rockland Broad Dec 3rd.

Bittern: Only 11 males booming regularly; 8 from the reedbeds along the North Coast, only 3 in the Broads. Winter sightings from Berney, Burnham Norton, Burnham Overy, Cley, Filby, Hickling, Holme, Horsey, Lynn Point, Pensthorpe, Salthouse, Snettisham, Stanford Water, Strumpshaw, Thompson Water, Titchwell, Tottenhill GP and Welney.

Night Heron: Welney, a second-summer bird May 11th-14th (JBK *et al*).



Little Egret: An adult at Welney May 10th-14th (JBK *et al*) and singles Ouse Mouth Aug 16th-17th (GMSE) and Welney Sept 19th (LB).

Grey Heron: Heronry details include Barton 6, Buckenham Carrs 12, Burgh Castle 3, Cley 5, Cockshoot 2, Didlington 8, Fishley 1, Fleggburgh Common 3, Fritton 12, Guist 4, Hickling (Sounds Wood) 9, Hilgay 54, Holkham Park 7, Islington 82, Narford 4, North Elmham 9, Old Hunstanton 4, Quidenham 5, Ranworth 5, Reedham Church Wood 2, Shadwell 1, Snettisham 8, Surlingham 3, Sparham 20, Sturston 10, Upton 1, Wheatfen 1, Wiveton Woods 1 and Woodbastwick Fen 1.

Purple Heron: Cley, an adult June 14th flew in from the east, settled in the reedbeds only for a few minutes before carrying on westwards (HPM).

Spoonbill: A first-year bird over-wintered at Holme/Titchwell/Brancaster and remained until at least April 20th. Other than 3 Hickling June 4th additional records of ones and twos March 26th-Sept 23rd at Berney, Breydon, Cley, Edgefield, Hickling, Holkham, Holme, How Hill, Ouse Mouth, Reedham, Strumpshaw, Surlingham, Terrington, Titchwell, Welney and Weybourne.

Later records from Cley, then Titchwell and then Snettisham Nov 18th-Dec 8th and probably the same bird Breydon Dec 11th-18th and 26th-31st. A seven-day visit to Gillingham coincided with its absence from Breydon.

Bewick's Swan: Largest concentration at Welney where 2,211 (3,700 total on Washes) Jan 16th, 1,700 Feb 13th, 300 Feb 26th, 70 March, 3 Oct 10th, 986 Nov 15th and 3,145 (4,981 total on Washes) Dec 18th when 24.8% young birds. Four injured birds summered.

Most impressive totals elsewhere (and doubtless duplication in numbers): Berney/Breydon/Halvergate 196 Jan, 698 Feb 15th, 402 March 4th, 128 Nov and 189 Dec; Ludham Bridge/St. Benet's Level 205 Jan, 230 Feb, 126 March and 126 Dec; Horsey 165 Jan and 85 Feb; Gelderston 185 Feb 18th.

Whooper Swan: Recorded to April 18th and from Oct 9th. Largest herds at Welney where 510 (603 total on Washes) Jan, 476 Feb, 538 March, 13 April, 8 Oct, 428 Nov and 462 (508 total on Washes) Dec; 11.7% young in Nov. Two injured birds summered.

Broads (Hickling/Horsey/Waxham) up to 40 Jan, 46 Feb and 40 Nov/Dec.

Bean Goose: Coded blue neck-banded individuals first appeared in the 1987/88 winter. A total of 36 birds had been marked during the moult at Vasterbotten (Sweden) on 20th July 1987 and 22 appeared in the Yare Valley that winter. The total included one bird carrying a ring code which was partly obstructed. Two others in this series stopped over in central Sweden and two more were seen in southern Sweden. In addition 15 of 'our' geese were found in north Denmark during Feb/March 1988. That summer at least ten birds returned to the moulting area where they had been neck-banded.

1988/89 winter: First arrivals in the Yare valley were 10 on Nov 18th with 138 next day, 210 by Dec 7th, 356 by Dec 17th and a peak of 370 Jan 5th; 348 remained on Jan 24th reducing to 260 next day and almost all had left before the end of Jan; an unusually early departure and probably due to exceptionally mild weather. Final observation was 22 at Haddiscoe Feb 1st. No neck-banded birds were accompanied by juveniles. Only one of the 22 marked individuals failed to return, showing a high degree of fidelity to the wintering site. One had been detected in central Sweden in Oct.

1989/90 winter: Yare Valley first arrivals (17) Nov 15th increasing to 101 next day, 227 by end Nov, 326 by end Dec and peak of 360 by Jan 27th; 310 remained till Feb 3rd declining to 182 by Feb 5th with final sighting (120) Feb 9th. A total of 14 carried neck-bands placed on them in July 1987 and, remarkably, each of these marked birds was traced to North Jutland (Denmark) Feb 25th-28th 1990. (Summary by MP-O).

Elsewhere: Berney 14 Feb 6th and 46 Feb 12th; Belton 18 Feb 2nd; Breydon 2 Jan 29th; Burgh Castle 23 Feb 10th; Holkham 3 Feb 20th to 28th and 6 Dec 14th; Martham Ferry area up to 28 Jan 29th to Feb 28th; Paston 3 Feb 4th/5th and Snettisham Dec 2nd with 14 Nov 20th.

Pink-footed Goose: Co-ordinated dawn counts on the Wash and on the North coast indicated the following figures for the NW Norfolk population:

1988/89 winter: Peak of 13,500 Jan 8th declining to 7,600 Feb 5th; last 10 at Holkham till April 12th then 2 till May 20th.

1989/90 winter: Autumn arrival from Sept 22nd (Holkham), 27th (Scolt) and 29th (Snettisham) and 200 in Brancaster area Oct 2nd, 12,250 Nov 26th, 20,000 Dec 24th, peak

of 26,920 Jan 16th, 25,430 Jan 30th, 13,960 Feb 6th and 3,500 Feb 24th.

White-fronted Goose: Largest numbers in Yare Valley where recorded to March 9th and from Nov 16th with 310 Jan, 215 Feb, 46 Nov and 220 Dec.

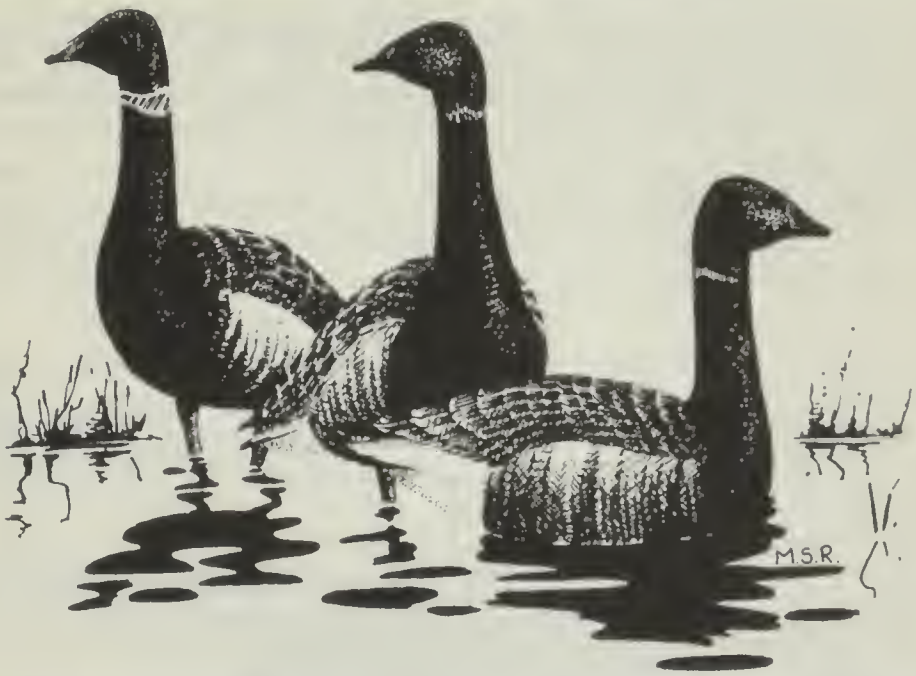
Elsewhere: Berney 16 Jan, 270 Feb, 12 Nov and 21 Dec; Heigham Holmes 12 Jan, 250 Feb/March; Holkham 206 Jan, 281 Feb, 170 March, 70 Oct, 81 Nov and 200 Dec; Welney 20 Feb, 42 March and 4 Dec.

Barnacle Goose: Following considered non-feral: Berney 11 Feb 5th with 10 next day; Cley 16 west Oct 9th and Brancaster one among Pink-feet during Dec.

Brent Goose: Recorded each month. Co-ordinated counts along the North Coast (Holme-Salthouse) gave the following totals: 12,711 Jan and 10,300 Feb. Wash: Snettisham 1,000 Jan, Ouse Mouth 2,500 Feb, Lynn Point 2,000 March and Terrington still 580 June 5th. No young observed.

The Dutch Brent Goose Research Group reports that among 45,000 Brents moulting on the delta of the Taimyr river this year no young birds detected indicating a complete breeding failure. Spring was two/three weeks late and the coastal sea remained ice-covered at the end of July. As a result the breeding islands were readily accessible to ground predators.

Ones and twos of the pale-bellied race *hrota* at usual localities.



Black Brant: Birds of the race *nigricans* at Blakeney/Cley/Salthouse Jan 1st-March 12th and at Lynn Point Jan 29th-Feb 12th.

Egyptian Goose: July counts in north Norfolk, Wensum Valley and Broads produced a total of 348 adults and 60 young with largest counts at Holkham Park 127, Sennowe Park 60, Lyng Easthaugh GP 42, Hoveton 31 and Blickling 30.

Shelduck: Ouse Mouth counts included 1,950 Jan, 2,112 Feb, 1,160 March, 1,575 April, 370 May, 4,200 July, 1,325 Aug, 350 Sept, 750 Oct and 3,100 Nov.

Peaks elsewhere: Snettisham 845 March, 1,175 Oct and 1,780 Nov; Breydon 702 June 24th.

Breeding sites away from coast: Cantley (133 juveniles), Filby/Fleggburgh, Flitcham, Gooderstone, Gunton Park, Hilborough, Hillington, Ranworth, Stanford, Thompson and Wissington BF.

Mandarin: Ones and twos at Cley, East Walton, Felbrigg, Gayton, Gunton (female with small duckling), High Kelling, Hillington GP, Holme, Letheringsett, Little Thornage, Sandringham, Seamere and Wereham.

Wigeon: Fens: Welney 10,492 Jan, 6,631 Feb, 7,920 March, 2,095 Sept, 3,214 Oct, 7,735 Nov and 14,285 Dec (when 53,000 total on Washes).

Peaks elsewhere: Buckenham/Cantley 8,950 Jan and 7,130 Dec and Holkham 1,300 Jan, 1,600 Feb, 1,380 Nov and 2,200 Dec.

American Wigeon: Welney: a drake first identified Dec 10th 1988 remained until Jan 16th (JBK JLN). Another drake there Dec 19th (JBK KW).

Gadwall: Highest numbers at Gunton Park: 496 Sept and 83 Oct. In addition Stanford 118 Sept; Martham 120 Nov; Surlingham 147 Dec and Strumpshaw 210 Dec.

Teal: Largest counts: 2,010 at Welney March with 2,950 there in Dec.

Green-winged Teal: Welney: A drake March 9th to April 7th (JBK) and on county boundary April 8th (GMSE).

Pintail: Highest counts: Breydon 163 Jan; Cley 510 Jan and 974 Dec 23rd of which 294 headed west; Narford 300 Sept; North Wootton 1,200 Jan; Snettisham 930 Feb; Tottenhill GP 280 Sept, 300 Oct 2nd and 570 Oct 13th; Welney 165 Jan, 200 Feb, 108 March, 670 Sept, 932 Oct, 450 Dec.

Garganey: Spring arrival from March 27th (Hockwold Washes) followed by 1-7 at Bayfield, Berney, Blakeney, Burnham Norton, Cantley, Cley, Hardley Flood, Hickling, Holkham, Holme, Pentney GP, Salthouse, Snettisham, Titchwell, Tottenhill GP and West Acre. Largest party 7 Cley May 4th. Breeding only confirmed at Welney where a brood of 4. Latest Welney Oct 8th.

Shoveler: Largest totals: Berney 120 March; Hickling 111 Feb; Hoveton Black Horse Broad 180 Nov; Narford 150 Oct and Welney 146 Jan, 157 March, 153 Nov and 141 Dec.

Red-crested Pochard: Beetley 3 (2 drakes) Dec 24th; Cley duck Dec 14th-27th; Titchwell duck Jan 21st-March 26th. Status confused by escapes from collections.

Pochard: Highest counts: Pentney GP 425 Jan; Welney 843 Jan, 1,108 Feb, 738 March, 357 Nov and 830 Dec. At Welney 3 Tufted × Pochard hybrids.

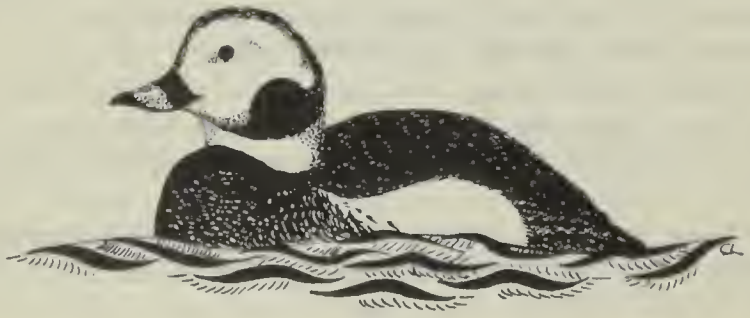
Breeding confirmed at Barton, Filby/Fleggburgh, Fowl Mere, Hickling, Horning, Holkham, How Hill, Ranworth, Sparham, Stanford, Strumpshaw, Thompson, Thurne Dyke, West Mere, West Tofts and Wroxham.

Ferruginous Duck: UEA Broad Jan 12th (PJD RSL).

Additional 1988: Pensthorpe 2 Feb 1st (SH) were in addition to the collection birds.

Tufted Duck: Most impressive winter counts: Flegg Broads 180 Feb; Stow Bardolph GP 608 Jan; Tottenhill GP 130 March and Welney 101 March.

Scaup: Apart from up to 9 moving between Stow Bardolph, Tottenhill and Pentney Pits Jan-Feb the largest group was 15 off Snettisham Feb 11th. Elsewhere scarce reflecting the mild winter.



Eider: Peak counts: Brancaster harbour 210 Feb 21st and March 21st; Cley 214 Nov 18th; Holme/Hunstanton 280 Jan 11th, 200 Jan 21st and 240 Nov 16th; Scolt 200 March and Sheringham 180 Nov 17th and 120 next day.

Long-tailed Duck: Most regular off Hunstanton/Holme/Thornham where monthly totals of 65 Jan, 95 Feb, 58 March, 16 April, 6 May, 4 Oct, 17 Nov and 19 Dec.

Elsewhere along North coast 1-25 at Blakeney, Brancaster, Cley, Holkham Bay, Overstrand, Scolt Head, Sheringham and Titchwell. Series of counts in Blakeney harbour: 3 Jan, 8 Feb, up to 8 first half April, 14 April 15th and 20 April 22nd.

Only two East Coast observations: Breydon where 1988 bird remained till Jan 18th and Horsey where 3 Feb 12th.

Common Scoter: Inshore counts included Hunstanton/Heacham 300 Feb 21st, 300 March 6th, 400 May 27th and 540 June 3rd; Thornham 400 Dec 27th.

Inland records: Breydon April 9th-26th; Bure (near Cockshoot) April 17th; Filby/Ormesby Broads Jan 2nd to 28th; Fowl Mere 5 July 13th and Welney 6 April 29th.

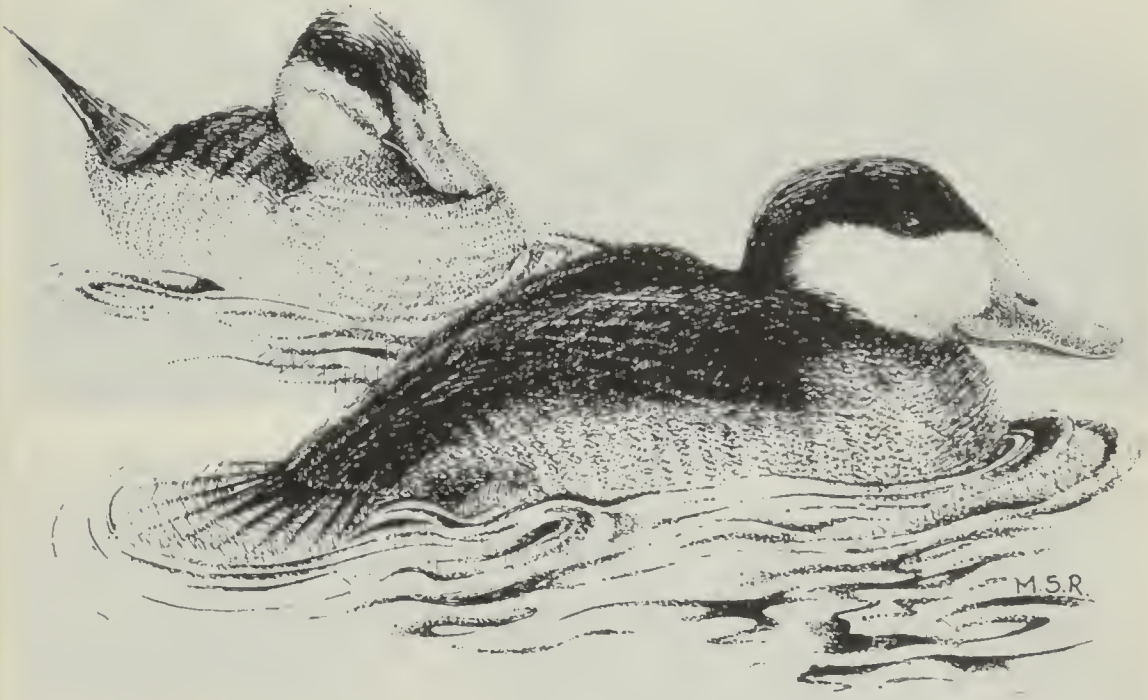
Velvet Scoter: Recorded each month. Largest parties: 25 Heacham Jan 10th and 27 Jan 22nd with 10 still present March 27th.

Goldeneye: Peak numbers: Blakeney 83 Feb 4th; Brancaster harbour 60 Jan 22nd and Snettisham 43 March 9th.

Smew: As expected in such mild conditions only singles reported up to March 17th and from Dec 28th at How Hill, Hickling, Holme, Snettisham and Welney.

Red-breasted Merganser: Largest groups: Snettisham 82 March; Hunstanton 47 Nov and Brancaster 55 Nov. Inland: Tottenhill GP Jan 22nd and Ten-mile Bank 2 Dec 31st.

Goosander: Winter groups recorded at 13 localities with maximum of 10 at Stow Bridge Jan 18th. An injured bird summered Lynn Docks Area May 7th-Aug 19th. Unusual record of one wintering at sea off Sheringham Nov 3rd-Dec 31st.



Ruddy Duck: 1-3 recorded from Blickling, Filby, Gunton Park, Heacham, Hickling, Horsey, How Hill, Martham, Narford, Ormesby, Pentney GP, Ranworth, Rollesby, Snettisham, Stanford, Thompson, Tottenhill GP and Welney. No evidence of breeding.

Honey Buzzard: Displaying birds at two sites: (1) male displaying regularly late May to early Sept and (2) records from late May with a pair displaying early June. May have bred successfully as a juvenile nearby Aug 21st.

Elsewhere: 15 records of migrants April 28th-Oct 19th with 6 in June when one over Norwich on 20th — the only one away from the coast. Of the remainder one over Holme/Thornham/Titchwell May 14th was an interesting 'chain' sighting and another in Weybourne/Kelling area Sept 14th-24th was the only lingering bird to be noted.

Black Kite: Kerdiston June 24th (SB).

Additional 1988: Dersingham May 12th (KPE).

Red Kite: Shereford Feb 11th (JL) was the only record.

Marsh Harrier: 62 adults raised 88 young. Six of the young fledged at three sites were strikingly patterned in white; similar birds were raised at three Suffolk sites.

Main winter roost in Broads (shared with Hen Harriers and Merlins) held 2 in Jan, 3 in Feb, 5 in March and Oct, 6 in Nov (not including 2 additional females on 1st) and 4 in Dec. At Welney a juvenile attacked and killed by drowning a drake Wigeon Sept 20th.

Hen Harrier: Last of spring at Cley May 28th; first of autumn at West Acre Aug 18th. Reports of roosting birds at 8 sites, but records covering both ends of year from only 3 localities. Counts for the main roosts: Broads: 6 in Jan, 7 in Feb, 6 in Nov/Dec and in the North: 9 in Jan, 10 in Feb, 8 in March, 5 in Nov and 6 in Dec.

Montagu's Harrier: Recorded April 15th-Sept 21st. Five females attempted to nest with the assistance of 3 males; 4 successful and 13 young fledged — a record number since wardening began in 1982. Away from the breeding area 3 records in April (involving at least 2 birds on 29th at Titchwell, Cley and Winterton), 6 in May, 3 in June and Aug and one in Sept.

Goshawk: Records from 3 main areas, but display reported from only one and no other evidence of breeding. Elsewhere singles at Lyng May 2nd (SB) and in off sea at Waxham

Nov 4th (GED).

Sparrowhawk: Spring peak of 7 migrants at Winterton March 30th and April 30th. Among more interesting observations: Female dashing into a group of 15 Jays at Frettenham, one attempting to catch a Ring Ouzel at Eccles and another taking Stock Dove and Collared Dove at Flitcham.

Buzzard: At Holkham one Jan 1st and then 2 at Bayfield 24th/25th one of which stayed until Feb 28th. Seven singles in March all but one in North and East; only 2 in April but 5 May 1st-13th again all in North/East. Last of spring at Brancaster May 29th.

In autumn from Aug 4th with 5 in North and West that month (including 2 at Heacham on 5th) and 7 in Sept. After 23rd only 5 records to year-end with a resident at Ryston mid-Oct to early Nov and 2 at Massingham Heath Dec 22nd.

Rough-legged Buzzard: Massingham Heath Jan 1st-Feb 25th with 2 March 14th-20th and one staying in area until 27th. Elsewhere: Horsey Jan 13th; Breydon Feb 10th; West Raynham 20th; Berney Marshes March 8th-28th; Cley March 26th; Weybourne (2 west together) 26th; Titchwell 27th; Horsey 29th and Winterton 30th.

No autumn records received.

Osprey: Spring records April 7th-May 28th from Blakeney Point, Brancaster, Briston, Cley, Cockley Cley, Hillington, Holme, Horsey, Holkham, Lyng area (April to May 14th), Salthouse, Sandringham, Snettisham, Titchwell, West Acre, West Runton and Wolferton.

Another Cley July 1st and then in Autumn from Aug 11th to Sept 26th at Blakeney Point, Edgefield (where a bird roosted at least Sept 21st-24th and presumably provided cluster of records along North coast around this time), Holme, Holt, Thornham and West Harling.

Kestrel: 33 young from 9 nest-boxes ringed in Stanford Training Area; also bred in 2 boxes erected on telegraph poles at Ten-mile Bank. No particularly high counts received and only 15 at Snettisham Aug 14th.

Red-footed Falcon: Single females at Winterton May 14th (DH RP), Sheringham 23rd (SJMG *et al*) and Winterton 24th/25th (PC) possibly all relate to same individual. Also immature male Cley June 17th-19th (LGRE SJMG DJH *et al*) and female Waxham Sept 14th (MF).

Merlin: Widely reported until May 16th (Blakeney Point) and again from Sept 9th (Cley). Roosting birds recorded at 4 sites with highest counts from Broads roost where up to 7 in Jan/Feb, 8 in Nov and 7 in Dec.

Hobby: Frequent and widespread reports April 24th-Oct 13th and at least one pair bred in Brecks. In addition adults seen carrying prey at 2 sites and 2 adults observed together at another 3. Good number of juveniles in autumn with 2 well-watched birds at Holme Sept 21st-29th and one at Holkham Meals Sept 22nd-Oct 13th which was joined by another 1st-7th.

Peregrine: Recorded on 15 dates to May 1st with 14 occurrences from Aug 18th. All coastal apart from adult Welney Jan 18th; male North Walsham April 7th and immature Welney Nov 18th. In addition a 1st winter female resident in Breydon/Berney area from Dec 19th until found dead riddled with shot in Jan 1990. Most productive site was Snettisham where reported 9 dates including the only sighting of 2 — Jan 14th. A bird at Cley March 18th was wearing jesses.

Red-legged Partridge: Overstrand: a juvenile July 27th landed on a calm sea, sinking after a few minutes and was later washed-up dead.

Quail: A remarkably good year following the warmest May for many years with widespread records from late in the month through to Aug. Localities are as follows: Blakeney, Boughton Fen, Brancaster Staithe (Deepdale), Brancaster (Barrow Common), Choseley/Ringstead (where peak of 12+ calling July 2nd with 4 additional birds calling within 2 miles July 13th-17th; family parties there in late July included one of 8 birds), Cley Walsey Hills, Cley Eye, Cawston (Eastgate), Docking, East Mere Farm (Stanford 'Battle Area'), East Walton, Feltwell/Hockwold, Flitcham, Glandford, Holme, Holkham, Kelling Heath, Langham, Marham, Mautby, Merton, Reedham marshes, Roydon Common, Southery Fen, Stoke Ferry Sluice, Salthouse, Stanhoe, Terrington (Admirals Farm), Thompson, Thornham Marsh, Ten-mile Bank (Manton's Farm), Tunstead, Welney, West Acre, Weybourne, Wood Norton, Wootton Marsh and Wissington BF.

In addition single migrants at Scolt May 25th and Weybourne Oct 5th.

Golden Pheasant: Records from Broughton, Dersingham, East Wretham, Harling, Hockham, Lynford, Sandringham, Santon Downham, Thompson, Wayland Wood, Weybourne and Wolferton. Best counts: 12 Drymere Jan and 10 males and 3 females together East Wretham Dec.

Water Rail: Bred at Cley, Surlingham and Welney.

Spotted Crake: Heard at Strumpshaw April 13th-15th and 23rd; Hickling June 9th-14th and Welney July 8th-13th. Also singles at Holme May 29th and Cley Aug 25th-Sept 9th.

Crane: Two disappeared early in the year, but an immature joined the Broadland group in June, staying until the end of the year and bringing numbers up to 8.

Not a particularly good year for birds outside the Broads although the distribution of dates is not untypical: Holkham April 2nd; Yarmouth 17th; 2 Holme and Titchwell 26th; 2 Strumpshaw May 5th; Thornham May 18th; Breydon June 14th and Cley Nov 11th.

Oystercatcher: Large concentrations in Wash at Snettisham where 11,830 Jan 10th, 12,270 Feb 8th, 7,720 March 10th, 2-3,000 summered, 4,410 July 22nd, 9,000 Aug 4th, 12,950 Sept 19th, 13,250 Oct 17th and 7,900 Nov 17th. Single white bird returned there Aug 2nd.

Breeding pairs: Cley 11, Blakeney Point 200+, Holkham Reserve 37, Scolt 78, Thornham 20 and Holme 14, but low success with heavy predation at some sites by Foxes and Carrion Crows. At least 12 inland breeding pairs.

Avocet: A disastrous breeding season with a county total of 170 pairs rearing less than 40 young. A combination of predation by Stoats, Foxes, Carrion Crows and humans being the main reasons for this low success rate. Largest colonies at Cley 75 pairs and Titchwell 45 pairs.

Tidal Ousemouth again favoured during the autumn with a peak of 122 July 31st; also 32 Snettisham Sept 19th. Recorded at Breydon (maximum 8) all months apart from Jan and Dec while 1-2 inland birds at Welney and Lakenheath Flashes in March. Feb records from Blakeney, Cley and Titchwell and a single wintered with Oystercatchers at Snettisham. Most birds gone by Nov.

Stone Curlew: Little information available. First seen at Weeting Heath March 29th with a small concentration of 12 Sept 5th. Birds present at 5 sites in Stanford Battle Area, but none nested. Following the decline of the Rabbit population the ground vegetation has become too long in recent years. Ploughing would undoubtedly assist the species here.

A total Brecks population (including Suffolk) of 90 pairs raised a minimum of 65 young.

Little Ringed Plover: Reported between March 20th (Horsey) and Sept 1st (Welney). County total of 30 pairs on territory, several noted as successful.

Autumn passage peaked in July when 10 Gillingham 13th, 27 Cantley BF 22nd, 11 Surlingham in July followed by 10 in Aug, 8 Cley 4th, 7 Wissington BF 13th and 8 Welney 17th.

Ringed Plover: Largest breeding concentrations on Blakeney Point (100 pairs), Holkham Reserve (46 pairs) and Scolt (90 pairs), but heavy predation at the latter site by Foxes, Stoats and Kestrels. At least 15 inland pairs at 12 sites.

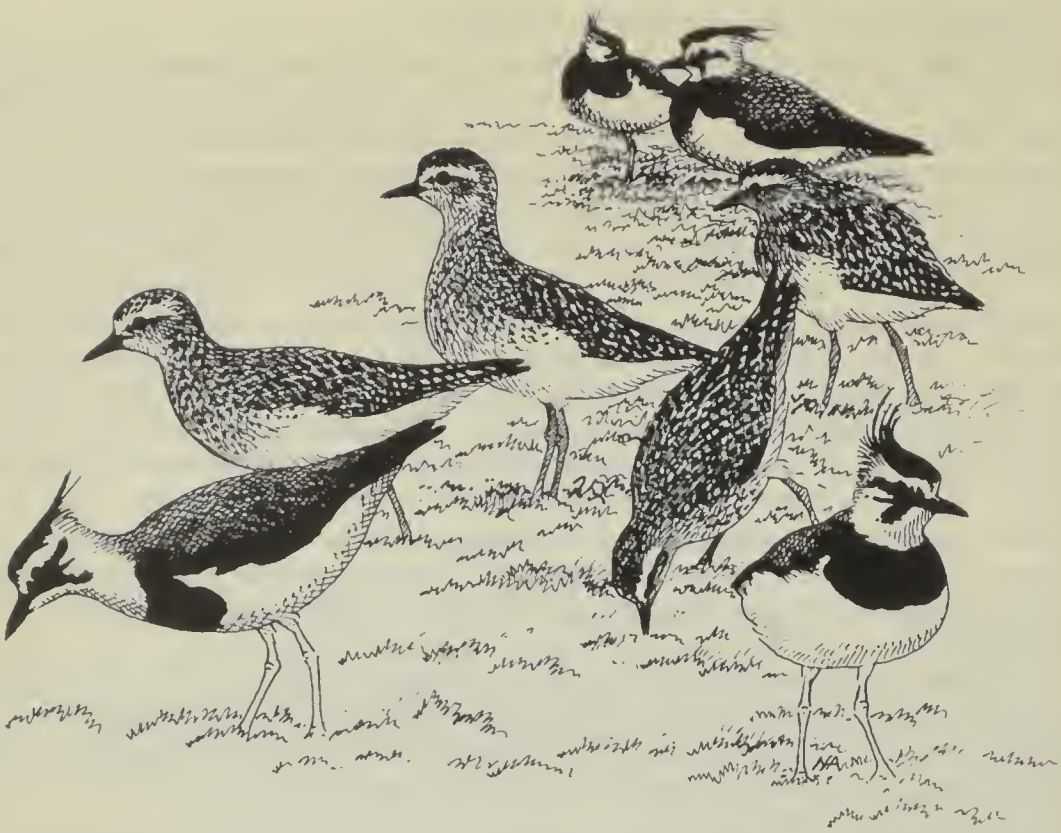
Highest counts of passage migrant *tundrae* include 180 Lynn Point and 30 Welney during May. Autumn gatherings of 350 Overy Dunes Aug 19th, 195 Snettisham July 22nd followed by 170 Aug 21st and 132 Lynn Point Aug 20th.

Kentish Plover: An early inland male at Pentney GP March 29th followed by records from Breydon of a male April 10th, Berney May 16th and Cley male April 8th and female April 27th-29th.

Dotterel: May passage first noted at Holme where 2 flew east May 2nd followed by 8 Happisburgh 7th, 5 Cley 9th, Paston 13th, Weybourne 14th, 2 Winterton 19th and 3 on 20th-22nd, up to 3 Blakeney Point 24th-31st and 6 Choseley 25th.

Autumn passage involved single Cley/Blakeney Point Aug 26th-Sept 2nd, 2 Choseley Aug 29th and 2 juveniles Weybourne Sept 21st-23rd.

Pacific Golden Plover: An elusive summer-plumaged individual frequented the Holme/Thornham Creek area between July 20th-22nd and again on 26th (GFH PJH AMS *et al*). A county first.



Golden Plover: Largest flocks were at Shipdham where 3,000 Jan 10th and 5,000 Dec 27th; Cley where 2,000 Jan 3rd and 2,300 Feb 11th and West Raynham airfield where 1,200 Feb 20th. Several other concentrations around the 1,000 total. Earliest returning autumn bird July 5th at Welney.

Grey Plover: Large gatherings on Wash at Snettisham where monthly peaks were 607 Feb 10th, 580 March 11th, 762 April 9th, 1,840 May 7th, 300 July, 710 Aug 21st, 1,205 Sept 19th and 800 Dec 17th.

Other notable flocks included 1,197 Lynn Point April 9th where 500 May 27th, 1,200 Titchwell Aug 20th, 269 Blakeney Harbour Aug 28th and 250 Brancaster Harbour Sept. High tide roosts of up to 160 birds also at Holme and Thornham Point in May.

Inland records from Welney mostly of singles March/April, May (3), Sept and Nov.

Sociable Plover: The Titchwell/Holme 1988 bird was in fact observed Sept 24th not 25th.

Lapwing: Mild weather in both winter periods saw large numbers remaining in the county rather than continuing to the south-west. Some of the largest flocks were at Breydon/Berney 5,000 Jan, 6,000 Feb and 5,500 Dec; Ludham 3,000 Feb; Shipdham 7,000 Jan and 5,000 Dec; Cley 3,400 Jan; Welney 2,000 Jan and Dec with many smaller assemblies elsewhere.

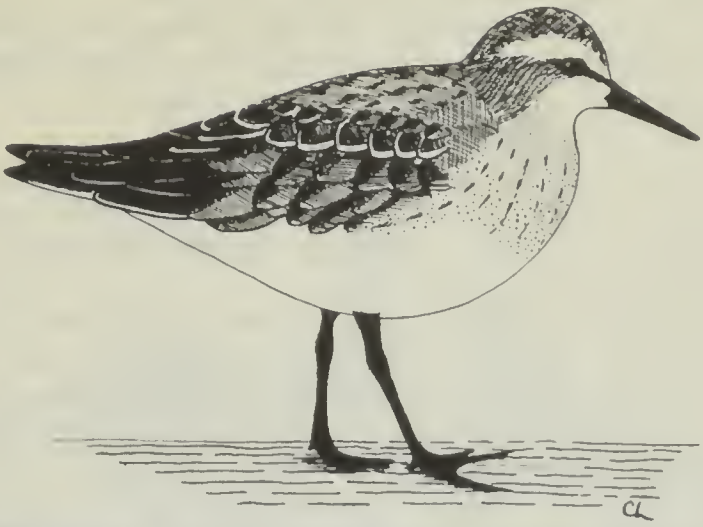
Knot: Largest flocks at Snettisham with counts of 28,000 Jan, 20,500 Feb, 5,000 March, 13,500 April, 1,000 June, 7,200 July, 19,250 Aug, 20,000 Sept, 80,000 Nov and 15,000 Dec.

A huge high-tide concentration of 90,000 Holme (Gore Point) Oct 15th while 6,000 Titchwell Aug 4th/5th and 9,000 Sept 17th.

Welney: an inland record of a single April 15th.

Sanderling: Wash counts at Snettisham of 325 June 3rd, 450 July 22nd, 1,315 Aug 4th, 365 Sept 18th and 190 Nov 15th. Also 170 Titchwell May 20th/21st and 100 Overy Dunes Aug 19th.

Inland sightings at Welney April 25th, 2 Pentney GP May 14th and Lakenheath Flashes May 30th.



Semipalmated Sandpiper: Cley: an adult summer-plumaged bird May 14th-17th (ME SJMG *et al*). The third county record.

Little Stint: Unseasonal records from Gillingham Flood where the wintering individual from Dec 1988 remained until Jan 25th. A late bird was again there Dec 19th-28th.

Spring passage commenced with an early bird at Cley March 26th followed by regular sightings of up to 3 birds April to early June. Also present at many other sites including Berney maximum 3, Hickling maximum 5, How Hill, Holkham maximum 4, Snettisham, Lynn Point, Pentney GP 2 and Lakenheath Flashes 2.

A flurry of pre-autumn migrants in late June when birds appeared at Gillingham up to 4, Hickling up to 9, Cley up to 8, Holkham up to 9, Welney 2 and Pentney GP 2.

Only small numbers of migrants on autumn passage July to Nov 10th from usual areas; largest count 10 Cley July 27th.

Temminck's Stint: A typical spring passage from May 7th (Cley). Recorded at 10 sites: Berney (maximum 6 May 17th), Hickling from May 10th (maximum 3 on 22nd), Cley (maximum 3 May 11th and 22nd/23rd), Holkham (maximum 4 May 22nd), Titchwell May 19th/22nd, Holme (maximum 3 May 22nd), Snettisham June 4th and 16th, King's Lynn BF May 18th, Lakenheath Flash May 16th and Welney May 19th-23rd. Possibly 35 birds in all.

A light autumn movement preceded by a mid-June passage when 3 Hickling 19th, Cley 10th-13th, Snettisham 16th. Otherwise noted at Cley July 2nd-4th and 16th, Holme July 21st-25th and Sept 9th and Snettisham July 4th and 21st. About 8 individuals.

Baird's Sandpiper: Additional 1988: Lodge Marsh Wells July 27th (MA JRMcC).

Pectoral Sandpiper: A spring migrant at Holkham May 11th-16th (BRS).

In autumn recorded at Cley Aug 31st then presumably the same Sept 3rd/4th joined by another bird Sept 5th-7th. This second individual, a juvenile, briefly at Weybourne and Salthouse (PDK TCD *et al*); a single remaining until 17th and 2 juveniles Sept 20th-22nd. Others at Lakenheath Flashes July 13th-15th (PJH DJH), Titchwell Aug 26th, Colney GP Sept 17th (CR) and How Hill Oct 2nd-5th (RA MJS SFS *et al*).

Curlew Sandpiper: Spring passage at Cley commenced with 2 April 25th followed by mostly small numbers into mid-May peaking at 12 May 13th and 16th. Occasional birds throughout June. Small numbers (1-3) also at Breydon (April 24th-25th), Berney, Holkham, Titchwell, Thornham Point, Lynn Point, Snettisham and Welney.

Only reported from 7 sites in autumn mostly at Cley where peaks of 11 July 27th and

Aug 11th and 15 Aug 18th. Autumn passage mostly involved returning adults with juveniles practically non-existent and few birds remaining after Sept.

Purple Sandpiper: Noted up to June 9th (Cley) and from Aug 25th (Titchwell). Highest counts as usual from Heacham-Hunstanton where 22 Jan, 14 Feb, 11 March, 18 Nov and 12 Dec. Small numbers regularly at Yarmouth harbour (maximum 5), Paston-Walcott (maximum 17 in March) and Cromer-Overstrand (maximum 5).

Dunlin: Wash counts: Snettisham: 11,000 Jan, 12,650 Feb, 12,000 March, 11,800 April, 5,920 May, 8,100 July, 11,450 Aug, 4,710 Sept, 14,970 Oct, 3,300 Nov and 5,000 Dec. Wolferton: 6,000 March, 4,000 April, 6,000 May, 500 Sept and 700 Nov. Ouse Mouth: 2,500 Jan, 3,000 Feb and 1,800 March.

Also 500 Cley Marsh July 28th and an inland peak of 110 Welney March 17th.

Broad-billed Sandpiper: An unprecedented May influx when a single Lynn Point on 7th (CD) followed by a series of records from Breydon/Berney where singles May 18th/19th, 2 May 20th/21st, 3 May 22nd, single May 23rd with another May 27th (PRA *et al*). Another bird commuted between Holme and Titchwell May 13th-24th (GFH PJR *et al*) and yet another was at Cley May 31st-June 4th (GA CL AMS *et al*).

One on autumn passage visited Breydon July 31st-Aug 1st (PRA PJH AS).

Ruff: The winter months produced records from Berney 21 Jan, 26 Feb and 28 Dec; Hickling 11 Feb; Strumpshaw 46 March; Salthouse 5/6 Feb; Blakeney 9 Jan; Titchwell 6 Jan and at Welney 1-4 Jan/Feb, 25 March and 120 Dec.

Spring passage peaked in early May with most birds quickly moving on. Largest counts: 50 Berney May 8th; 125 Cley May 5th; 46 Holkham May 5th followed by 59 May 22nd; 23 Holme May 5th; 22 Lynn Point May 7th and 80 Welney May 6th.

Largest groups in autumn: 80 Cley July 17th/19th with few in Aug but increasing to 58 Sept 4th; 23 Holkham July 10th; 23 Holme July 18th-25th while monthly peaks at Welney were 60 July 30th/31st, 97 Aug 28th, 108 Sept 26th, 120 Oct 23rd and 145 Nov 30th.

Possible breeding at Berney where a juvenile present in June. No other evidence of breeding although lekking observed at Welney and Cley.

Jack Snipe: Noted up to April 26th (Welney) and from Sept 11th (Blakeney Point) when an early bird was in suaeda. Otherwise ones and twos reported from 25 sites.

Snipe: County total of 242 drumming birds though no counts received from some areas. Largest concentrations from Norfolk section of Ouse Washes (164 drummers), Holkham (25) and Strumpshaw (22). Winter counts included Berney 150 (Jan) and 190 (Nov) with 200 Cley Aug 12th.

Long-billed Dowitcher: A summer-plumaged bird briefly at Titchwell June 18th (AMS NS JT RW *et al*). The fourth county record.

Woodcock: A concentration of 15 roding birds in Holkham Park area, but the handful of other display records received give no indication of true status.

Several freshly arrived coastal birds in Oct/Nov from Winterton, Cley and Blakeney Point; also one off the sea at Holme on the odd date of Jan 11th.

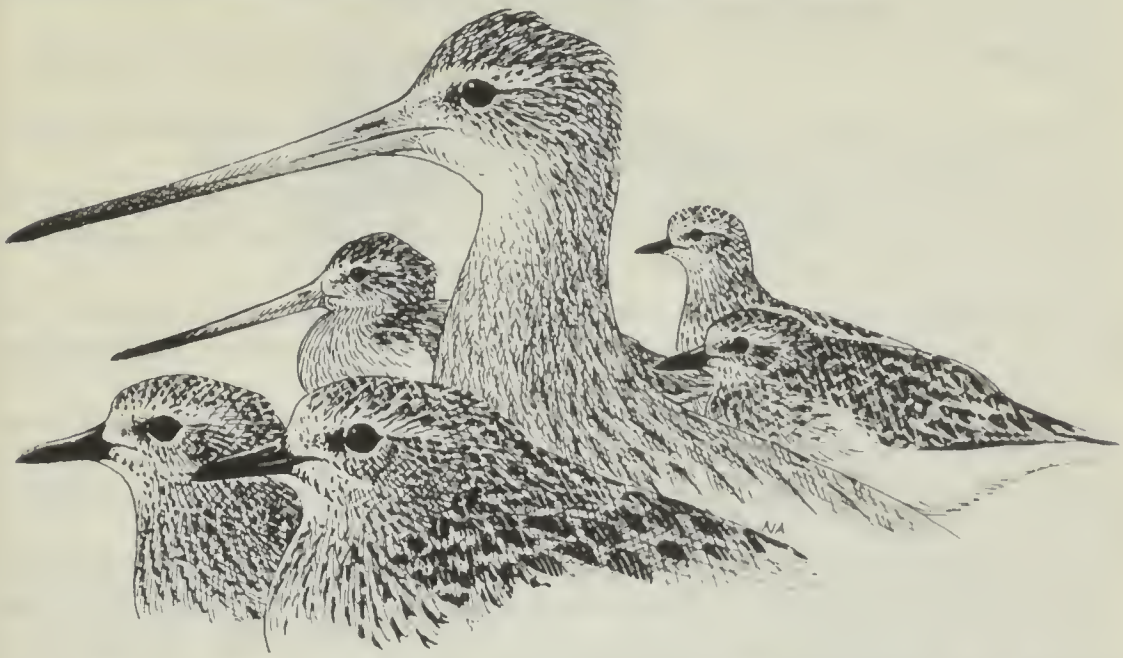
Black-tailed Godwit: Occasional winter records (1-8 birds) from Breydon (Feb, Dec), Cley (Jan), Titchwell (Jan) and Ousemouth (Jan).

An above average spring passage with peaks of 40 Titchwell April 7th, 340 Cley April 7th, 13 Holkham April 10th and 20 Breydon May 29th. 600 Ousemouth March 3rd had probably been flooded off the Ouse Washes where there were large concentrations of Icelandic passage migrants. Highest counts on the Ouse Washes at Welney were 570 March 8th, 620 March 21st, 1,084 March 22nd, 920 March 23rd gradually reducing but still 80 April 19th.

Autumn peaks of 50 Cley July 5th and Aug 5th, 12 Holkham July 10th, 40 Welney

July 13th and 27 Oct 15th and 500 Ousemouth Aug 16th/17th.

Two breeding groups in the Welney area of 8 and 3 pairs, but only one pair successfully rearing young. High water levels April/May caused 5 of these pairs to nest on adjacent arable where at least 2 pairs hatched young although none survived.



Bar-tailed Godwit: Largest counts consistently from Snettisham where high tides produced 3,600 Jan 11th, 860 June 4th, 3,500 Aug 21st and 1,500 Dec 4th. Other notable concentrations: 2,000 Titchwell/Thornham Oct 15th and 1,500 Nov 15th; also 250 Brancaster Harbour Jan.

Out of season 'red' birds at Overy Staithe Jan 4th/5th and again Dec 26th; also 3 Blakeney Harbour Jan 15th. One or 2 inland birds at Welney on 5 dates April/May with 11 May 6th.

Whimbrel: Noted between April 3rd (Snettisham) and Oct 8th (Lynn Point). Largest spring flocks: 42 Breydon April 28th, 24 Horsey May 10th, 58 Cley/Salthouse May 6th, 18 Holkham May 4th and 12 Lynn Point May 7th.

As usual most impressive numbers observed on autumn passage when a huge concentration of 400 Salthouse Aug 27th, 57 Blakeney Point Aug 6th, 53 Wells/Holkham Aug 5th, 42 Brancaster Harbour Aug 2nd (where total autumn movement involved 400+ birds), 20 Thornham Creek July 21st, 76 Holme Aug 2nd, 20 Snettisham July 27th followed by 21 Aug 23rd.

Inland records from Welney April 21st/23rd, 3 May 6th, July 31st, Aug 23rd and 4 Aug 9th. A flock of 19 Pentney GP Aug 26th.

Curlew: No reports of breeding received. Largest Wash counts at Snettisham: 965 Jan, 477 Feb, 877 Aug, 477 Sept, 760 Oct and 462 Nov.

Elsewhere a record Breydon count of 530 Nov 25th and 650 Brancaster Harbour July 23rd where winter population around 450 birds.

A heavy easterly passage at Cley April 20th involved flocks of 20-30 birds but also several of 100+ and one each of 225 and 400 birds.

Spotted Redshank: Winter records of 1-2 from Breydon (Feb, Dec), Burnham Norton (Feb), Brancaster (Jan) and Titchwell (Feb, Dec).

Highest spring numbers from Hickling 16 May 5th, Cley 16 April 18th and 20 May 4th and Snettisham 10 May 2nd. Substantial numbers also present in June when 4 Hickling 11th, 28 Cley 23rd and 7 Holkham 13th.

Autumn passage obvious mainly at Cley where up to 25 July/Aug and 20 Sept 19th. Small numbers at 7 other sites during the year.

Redshank: Peak Wash counts at Snettisham were 940 Jan-March, 1,160 April, 950 July 24th, 2,500 Aug 22nd, 3,460 Sept 18th, 1,450 Oct 17th with 500 wintering. Up to 26 pairs breeding on Holkham fresh-marshes.

Greenshank: Winter records from Blakeney (Dec), Titchwell/Holme (Dec) and Snettisham (Dec).

Spring passage peaked in May when 15 Hickling 24th, 7 Cley 21st/24th, 10 Holkham 21st, 17 Snettisham 27th, 5 Lakenheath Flashes 8th and 13 Welney 8th.

Largest numbers in autumn included 45 Breydon Aug 17th, 60 Cley Sept 17th, 15 Blakeney Aug 26th, 16 Holkham Aug 5th, 16 Brancaster Aug 22nd, 20 Titchwell Oct 2nd and 33 Snettisham July 23rd where 36 Aug 17th.

Green Sandpiper: Mild conditions resulted in overwintering birds at 32 sites, mostly 1-2 but notably up to 9 Bayfield Lake (Jan/Feb), 3 Gt. Melton (Jan) and 8 (Dec) and 3 Marham (Feb and Dec).

Small numbers noted on spring passage at 20 sites. Widely scattered in autumn and most favoured areas as follows: Cantley BF 19 July 2nd and 28 Aug 1st, 19th and 28th; 12 Gillingham July 11th, 11 Cley Aug 26th and 13 Sept 19th, 30 Holme July/Aug, 16 Wissington BF July/Aug and 11 King's Lynn BF Aug 21st.

Wood Sandpiper: Small numbers on spring passage at 13 sites from April 29th (Holme) — this individual was killed by a Sparrowhawk May 1st. Mostly one or two birds, but up to 6 Berney May 6th-31st, 5 Cley May 23rd-27th, 4 Holkham May 13th and 25th, 3 Holme May 22nd/23rd and 3 Lakenheath Washes May 14th.

A mediocre autumn passage with 1-2 birds at 15 sites, largest counts being 5-6 Cley July 15th-31st and 5 Aug 21st. Last recorded at Breydon Sept 28th.

Common Sandpiper: Winter records from Cley Jan 14th-Feb 28th and again Nov 21st and Dec 17th/18th. Also at King's Lynn BF Jan-March and Oct-Dec.

Otherwise extreme dates April 9th and Nov 5th (Berney). Maximum spring numbers 8-9 Cley May 6th and 21st.

Widespread autumn movement with largest counts 20 Breydon Aug 25th, 26 Cantley BF July 22nd, 11 Surlingham Aug 25th, 20 Cromer Pier Aug 26th, 18 Cley Aug 7th, 19 Lynn Point July 27th-29th and 15 Aug 21st-27th and 14 Wissington BF Aug 11th.

Turnstone: Largest counts at Snettisham: 80 Jan/Feb, 140 March, 275 April, 185 May, 410 Aug, 390 Sept and 60 Dec. Two notable flocks in Brancaster Harbour: 240 Jan and 210 Sept as well as 361 Sheringham roost-site.

Several inland records with singles King's Lynn BF Aug 27th/28th; Tottenhill GP Aug 11th; Wissington BF 2 May 21st and at Welney where singles April 23rd, May 3rd, 2 May 4th, May 6th, 11th and 25th with 2 Aug 26th.

Red-necked Phalarope: A typical scatter of records with a summer-plumaged bird at Hickling June 5th (TRB *et al*) followed by autumn juveniles at Welney Aug 27th-Sept 2nd with another Sept 17th/18th (JBK LB *et al*), Thompson Water Sept 6th and 8th (JW) and on the sea at Cley/Salthouse Sept 11th/12th (JH *et al*).

Grey Phalarope: All records concern birds at sea: Singles flying east off Sheringham Sept 28th (KBS), west off Weybourne Oct 8th (JW) and one in Holkham Bay Oct 14th (GMSE). Following a strong WSW gale Oct 29th a total of 8 flying west and one east off Sheringham Oct 30th (PJH BWJ) and a single on the sea off Cley later in the day was presumably one of these individuals.

Pomarine Skua: Spring migrants off Paston May 29th and 31st.

Autumn passage between July 16th and Nov 23rd, mostly from North Coast areas. A

total of 157 birds with monthly figures as follows: 7 July, 35 Aug, 61 Sept, 34 Oct and 20 Nov. Peak days: Sept 9th/10th (33) and Oct 7th/8th (24).

Winter sightings from The Wash Jan 4th when 2 followed the fisheries vessel *Protectoril*, Holme Jan 10th/11th and Cromer Feb 14th.

Arctic Skua: A few spring and early summer records of singles from Titchwell March 25th, Trimingham March 26th, Cley May 7th, Waxham May 27th, Blakeney Point June 2nd/4th and Thornham Point and Cromer June 24th.

Autumn passage between July 2nd (Breydon) and Nov 22nd (Cromer) when widely observed around the coast. Largest movement Aug 27th when 81 east at Paston, 160 Sheringham, 120 Cley, 90 Holme and 130 Hunstanton. On Sept 9th there were movements of 35 Sheringham and 50 Holme.

Four records of 3-20 flying inland at Ousemouth in Aug/Sept. An unusual sight was that of 3 mobbing a Marsh Harrier at sea off Snettisham Aug 20th.

Long-tailed Skua: A total of 13 individuals (7 adults) between July 30th and Sept 9th off coast between Paston and Holme.

Great Skua: Single winter birds off Snettisham Jan 14th, Holme Jan 17th and at Ousemouth Feb 1st. Two spring records: Holme April 10th and Ousemouth April 16th.

Autumn birds noted July 31st to Nov 23rd from many coastal sites. Largest movements Aug 27th when 54 Cromer, 65 Sheringham and 40 Cley/Blakeney Point; Sept 9th when 71 Cromer, 150 Sheringham, 120 Cley/Blakeney Point, 89 Holkham Bay, 45 Holme and 66 Ousemouth of which 39 flew inland; Sept 10th when 50 Waxham, 45 Cromer and 55 Sheringham; and Oct 8th when 80 Sheringham, 68 Cley/Blakeney Point, 99 Holme and 39 Hunstanton.

One killed and ate a Lapwing from a migrating flock off Hunstanton Aug 20th.

Mediterranean Gull: Observed most consistently at Yarmouth where 1-2 adults from Jan-March 19th and from July 2nd-Dec, 2nd winter from Nov 6th to Dec 31st and a 1st summer May 3rd, May 17th and July 10th. Elsewhere an adult (presumed returning bird of previous winters) off Overstrand for much of the year. At Breydon 1st winter Jan 9th and Sept 2nd with 1-3 (each 1st summer) April 12th to June 30th. At Cley/Blakeney Point up to 2 adults in April, Aug/Sept, 2nd winter Oct 8th, Oct 14th and Nov 17th, 1st winter Aug-Nov, 1st summer April 27th-29th, May 13th/21st and July with a 2nd summer Oct 7th.

In addition: Weybourne adult Sept 21st; Salthouse Dec 23rd; Cromer Pier 2nd summer

April 10th, 1st summer July 2nd, 17th and 31st, adult Aug 1st and another Nov 9th; Sheringham 1st summer April 8th and June 29th, adult Aug 4th/5th, 2nd winter Sept 28th, adult Sept 30th to Oct 5th and 2nd winter Nov 9th; Holkham adult Oct 23rd and Nov 19th; Burnham Overy adult Dec 26th; Brancaster July 31st; Titchwell 1st winter Feb 22nd, 2 adults April 11th-14th and Nov 19th; Thornham adult associating with Pacific Golden Plover July 22nd, 1st summer May 7th; Choseley 2nd winter March 4th and adult Sept 4th; Holme 1st winter Feb 28th, March 26th, adult Aug 3rd and 25th, 1st winter Oct 28th and Nov 9th/10th; Heacham adult Oct 2nd and Oct 21st; Snettisham adult Feb 18th/19th, June 17th and Aug 18th; King's Lynn 1st winter Feb 5th.

Inland: Burgh Castle adult Jan 8th, 1st winter April 15th and Nov 1st; Massingham Heath 1st winter Feb 11th and East Mere (Brecks) 1st summer July 12th. A long dead (1st winter) bird Blakeney Point Oct 20th.

A 2nd winter hybrid with Black-headed Gull at Heacham Oct/Nov and a 1st summer hybrid with Black-headed Gull at Breydon April 25th.

Little Gull: Unusually large numbers in the north-west of the county during the opening months of year. Counts from Holme/Hunstanton included 73 Jan 8th, 93 Jan 10th and 30 Jan 16th; also noted at Weybourne 9 Jan 4th and Yarmouth Feb 3rd.

Only a light spring passage when birds at Breydon/Berney up to 10 May 6th-18th; Filby 2 April 14th; Hickling maximum 16 May 28th; Cley maximum 10 May 4th; Holkham Park April 11th, May 7th and 12th while the fresh-marshes held 1-2 May 22nd/23rd; Snettisham 5-6 May 25th-27th; Lynn Point 8 April 4th; Denver Sluice April 24th; Welney April 8th to June 21st maximum 8 May 23rd and Pentney GP May 4th/5th.

A few immatures (2-6) summered at Hickling and Barton Broads and Snettisham.

Largest autumn movements occurred between Oct-Dec and were on average later than usual. Highest counts: Sheringham 50 Oct 8th, 55 Oct 30th and 100+ Nov 5th; Weybourne 52 Dec 11th; Salthouse 7 Dec 28th; Cley/Blakeney Point 150 Nov 5th, 35 Nov 22nd and 40 Dec 10th; Holkham 30 Nov 5th and 123 Dec 8th; Brancaster 10 Dec 22nd and Hunstanton/Holme 50 Oct 7th and 12 Dec 19th.

Sabine's Gull: A total of 9 birds (5 adults) as follows: Aug 27th an adult Hunstanton (PJL) and 2 adults moving east and observed from Weybourne, Sheringham and Cromer (SCV MN KBS *et al*); Sept 3rd a juvenile off Cley (RJ RM); Sept 9th juvenile off Cley (DJH); Sept 10th adult off Cley-Weybourne (PDK PAGR *et al*); Sept 21st adult Hunstanton (MR); Oct 2nd juvenile Sheringham (GC) and a late juvenile Nov 5th off Cley/Blakeney Point (BWJ PL ETM *et al*).

Black-headed Gull: Number of *pairs* at main sites: 1,500 Blakeney Point, 2,800 Wells saltmarsh, 300-400 Scolt but few successful due to Fox predation, 834 Snettisham and 400 Wissington BF.

Common Gull: Blakeney Point a pair hatched 2 young.

Lesser Black-backed Gull: Bred at Blakeney Point (2 pairs) and Wells saltmarsh (20 pairs).

Herring Gull: Bred at Blakeney Point (40 pairs) and Wells saltmarsh (29 pairs).

Northern race *argentatus* reported from Cley/Blakeney Point and Taverham up to March 5th and from Nov onwards as well as at Sheringham Jan/Feb and Oct-Dec; Blakeney Point July 29th; Holme April and Aug and Heacham Jan and Nov.

Yellow-legged individuals at Breydon July 29th, Yarmouth Aug 14th, Berney Oct 8th and Nov 5th, Hickling/Horsey area May 24th, June 17th and July 24th, Tunstead 2 Oct 3rd, Cley Sept 16th, Burnham Deepdale Aug 12th, Wereham Feb 24th and Pentney GP Jan 2nd.

Iceland Gull: A first-winter bird at Yarmouth/Gorleston Jan 1st to March 19th (many observers) with a second-winter bird Jan 1st (GRO) and Feb 23rd (PJH) and nearby at Caister April 30th (GRO).

Also seen at Breydon (1st winter) May 4th (PRA), Winterton Feb 18th, Weybourne adult Nov 22nd (JW), Cley/Salthouse 1st winter Dec 17th and 24th (PC PDK) and Blakeney Point (2nd winter) Nov 25th (MPT).

A series of records of first-winter and second-winter birds at various points along the North Coast in April probably relate to just 2 individuals: Cromer (2nd winter) April 9th and 1st winter April 16th (SCV MPL), Sheringham (1st winter) April 8th (KBS), Cley (2nd winter) April 16th-19th (OAMS) and (1st winter) April 8th, Blakeney harbour (1st winter) April 16th (SJMG SCJ) and Holme (1st winter) April 21st.

Glaucous Gull: Blakeney Point/Cley/Weybourne: A regular adult up to Feb 25th and from Sept 25th until end of year with 2 adults Feb 19th, 2 (1st winter) birds Jan 22nd-Feb 8th with another April 8th/9th, an immature (1st summer/2nd winter) was present from July until the year-end.

Many other scattered records of singles from Yarmouth adult Feb and Oct; Breydon Feb 2, March and Dec; Caister Feb; Waxham adult March and April 11th-15th; Paston April; Cromer April; Sheringham Feb-April and Sept; Holkham March; Titchwell/Thornham May and June; Hunstanton/Holme adult Jan-March, Oct and Dec; Heacham Jan/Feb; Snettisham Oct; Lynn Point Nov and inland at Attlebridge and Taverham both Jan.

Individuals resembling hybrid Glaucous Gulls at West Runton May 1st, Sheringham/Cley from July 1st, Titchwell April and Heacham Jan/Feb (same bird as Dec 1988) — all 1st winter or 2nd winter.

Kittiwake: An estimated 20,000 east off Sheringham between 0930 and 1530 hours Nov 22nd.

Sandwich Tern: Extreme dates March 9th (Salthouse) and Dec 9th (Cley). At Scolt 3,000 at evening roost by early May and 1,050 nests July 3rd — most soon deserted and no young reared due to Fox activity. A better season was enjoyed by 1,500 pairs at Blakeney Point. Inland occurrences at Welney May 21st and Flitcham July 24th. At Lynn Point 48 flew high inland Sept 17th.

Additional 1988: A very late bird off Cley Dec 17th (HPM).

Roseate Tern: Remains a rare visitor. Single adults at Cromer Aug 13th (MPL) and Paston Sept 9th (MF).

Common Tern: Observed between April 14th (Scolt and Filby) and Nov 10th (Titchwell). Only 758 pairs were reported as breeding. Looking back 20 years to 1969 shows Blakeney Point then held 1,200 pairs and Scolt 500 pairs with a county total close to 2,000 pairs.

Number of pairs at major colonies in 1989: Breydon 95 pairs on tern platforms reared 77 chicks; Blakeney Point 240 pairs but low fledging due to Herring Gull predation; Holkham NNR 66, but few if any young fledged due to unknown predators; Scolt 159 but only 10 young fledged due to heavy Fox predation and Snettisham 97 pairs. Other significant colonies at Hardley Flood (30), Hoveton (23) and Ranworth (22).

Arctic Tern: Recorded April 4th (Weybourne) and Nov 15th (Salthouse). Breeding occurred at Blakeney Point (4 pairs) and Scolt where one pair was predated twice.

A light spring passage when birds at Breydon May 19th; Weybourne 17 May 22nd; Cley/Blakeney Point April 11th, 5 on 22nd and 5 on 25th; Holkham Bay 2 May 2nd; Titchwell 2 May 5th; Welney where northward migration included 4 April 19th, 18 April 20th, 3 April 22nd, 23rd and 5 April 27th and Pentney GP April 21st and May 3rd.

Only small numbers in autumn and no group exceeded 8 birds. Observed at Yarmouth, Sheringham, Cley/Blakeney Point, Snettisham and Lynn Point. Scarce inland in autumn but a juvenile at Welney Aug 27th after strong winds.

Little Tern: Recorded April 12th (Overy Staithe) and Oct 22nd (Holkham). A concentration of 220 Ousemouth July 12th. Two inland records: Lakenheath Flash 2 May 3rd and Pentney GP July 30th.

A decline to 477 breeding pairs (561 in 1988). The largest colony at Yarmouth where 180 pairs fledged 160 young despite an estimated 60 chicks predated by Kestrels. Heavy predation at other colonies by Foxes, Stoats, large Gulls, Oystercatchers, Magpies, Crows and high tide flooding enabled only 97 young to be fledged by remaining 297 pairs.

Whiskered Tern: Welney: an adult May 12th/13th (JBK *et al*) also visited the Cambs section of the Ouse Washes. The 18th county record.

Black Tern: First at Holme April 9th with other early April sightings at Rollesby on 11th and Holme/Titchwell on 14th. Spring passage occurred in two main waves commencing during the first ten days of May when noted in small numbers at 18 sites. Largest groups were 7 Lakenheath Flash and 7 Welney both on 6th; 7 Hickling on 7th; 6 Hoveton, 16 Barton and 7 Rockland all on 8th; 8 Strumpshaw, 12 Hardley and 7 Pentney GP all on 9th.

A further movement took place around May 19th-22nd when appeared at 13 localities — mostly in small numbers — but 13 east Weybourne, 21 Cley/Blakeney Point, 6 Holkham, 8 Titchwell and 11 Snettisham all on May 22nd.

A few unseasonal June records 2 Thornham Point 4th, Cley 18th and 5 Breydon 21st. A very quiet autumn passage being seen at only 4 sites with a total of 38 birds including 23 at Cley Sept 9th.

Black Guillemot: Singles at Weybourne Feb 9th (JW) and Cromer Oct 29th (MS).

Little Auk: One picked up in Salthouse village Jan 7th. In autumn recorded on many dates on North East coasts Oct 27th-Nov 29th with peak numbers 22 Cley Nov 1st and 12 Paston and Sheringham on same date, and 20+ east Sheringham Nov 22nd. In December singles Holkham 3rd and Salthouse 9th.

Puffin: In first winter period 1-2 Cromer Feb 11th and singles Weybourne Jan 4th and Holme March 27th and April 12th. Unprecedented autumn passage Aug 27th-Nov 22nd with birds moving mainly eastwards along north coast on at least 30 days. Mainly records of ones and twos with peaks of 18 Sheringham Sept 8th and 10 Blakeney Point Oct 8th.

Collared Dove: Largest counts 100 Shrumpshaw Jan 1st and 120 Limpenhoe Feb 6th.

Turtle Dove: Earliest record Titchwell April 15th. Notable visual spring passage mid-May with 117 west Weybourne on 14th and 20 west per hour Cley on 16th, when also 200 south at Snettisham. A very late bird Winterton Nov 11th.

Ring-necked Parakeet: Isolated records from Blakeney Point, Breydon, Burnham Norton, Caister, Cley, Hickling, Holkham Park, Holme, Langham, Snettisham, Waxham, Weybourne and Winterton.

Cuckoo: Simultaneous arrival April 9th when records from Cley, Pensthorpe and Weybourne.

Barn Owl: Recorded during year at 172 localities.

Little Owl: Recorded during year at 64 localities.

Tawny Owl: At a farm on Salthouse Heath an individual seen attacking nests of House Martins, eventually taking all the young from 7-8 nests present.

Long-eared Owl: At a Fenland site 6 at a winter roost March 11th and 14 there Dec 2nd. Also 4 roosting in hedgerow North Barsham March 30th-April 3rd. Spring migrants at Cley March 20th, Weybourne April 16th, Northrepps (in observers' garden) April 18th, Berney April 28th and Yarmouth April 30th. Breeding records only received from 3 Brecks localities and one North Norfolk site. Autumn coastal migrants at Weybourne Sept 9th, Blakeney Point Sept 10th, Oct 8th and Oct 28th/29th, Winterton Oct 4th and 28th, Waxham Oct 8th, 2 Cley Oct 29th (one flying in off sea being mobbed by an Arctic Skua) and Sheringham Nov 22nd.

Short-eared Owl: During RSPB winter survey of Yare Valley estimated total of 50 present in February with maximum of 13 Haddiscoe Island on 13th. Two pairs bred between Wolferton and Lynn Point. At Cromer one seen quarter mile out to sea on the unusual date of Aug 30th. At least 8 watched flying in off sea Sept 26th-Nov 28th between Weybourne and Blakeney Point.

Nightjar: A spring migrant flushed on Scolt Head May 25th. The 1988/9 RSPB Breckland survey produced a total of 229 churring males of which 135 were in Norfolk. Elsewhere churring males at Dersingham (3), Kelling Heath (4), Roydon Common (6), Salthouse Heath (4), Winterton (2) and Wolferton (3), where a male churring mid-day June 18th. Autumn migrants at Weybourne Aug 5th and Snettisham Aug 15th.

Swift: An early migrant Weybourne April 10th, but no other records until singles at Cley, Field Dalling and Sparham on 22nd, followed by widespread arrival in small numbers 25th-27th. A partial albino at Weybourne May 28th and June 18th and presumably the same bird at Cley July 1st and 14th. At Winterton 1,500 south in 1½ hours during evening of June 25th. No late records received.

Hoopoe: Singles at Gorleston April 8th, Salthouse Heath April 24th and later at Weybourne April 27th-29th, another at Weybourne on the unusual date of July 4th. West Runton Sept 13th-15th and Taverham (Thorpe Marriott) Nov 15th-17th.

Wryneck: In spring singles at Wiveton Downs April 17th, Hickling April 23rd, Holme April 25th, 29th/30th and May 6th, Yarmouth and Filby April 30th and Repps (window casualty) May 7th. In autumn Yarmouth Sept 9th-19th, Winterton Sept 12th-19th with 3 on 19th and one Oct 11th/12th, Sea Palling Sept 13th, Blakeney Point Sept 6th-13th with 2 on 12th, Blakeney Village Sept 17th, Morston Sept 20th, Wells (East Hills) Sept 9th, Holkham Meals Aug 28th-30th, 3 Sept 10th-12th, 2 13th and singles 14th and 20th, Overy Dunes Sept 12th, Thornham Point Sept 12th/13th, Holme Oct 1st and inland at Harleston 2 days end Sept. At least 4 records refer to sitings in observers' gardens.

Great Spotted Woodpecker: A Continental migrant flew in off the sea Weybourne Oct 19th.

Woodlark: Coastal migrants at Weybourne (flying west) March 10th, Burnham Deepdale Oct 28th and Winterton Oct 28th-30th. A notable and pleasing increase in Brecks where grand total of 63 territories, of which 39 in Norfolk.

Shorelark: None recorded in first winter period. In second winter period noted as follows:— Waxham 2 Nov 3rd; West Runton Nov 4th and 18th; Weybourne 2 west Oct 17th and 2 east Oct 26th; Salthouse 3 Oct 31st-Nov 5th then 5 until end of year with 6 Nov 9th; Cley up to 6 Oct 25th-27th; Blakeney Point Oct 16th, 3 Oct 17th-20th and one Nov 5th; Brancaster Nov 24th; Titchwell 2 Oct 24th; Holme 2 Oct 23rd and one Dec 18th and Snettisham Sept 26th with up to 5 Oct 8th-18th.

Sand Martin: First noted Titchwell March 8th with records from 7 further localities March 9th-12th. A survey between Sheringham and Weybourne revealed 594 burrows in use, the previous highest count being 269 in 1981. This species is clearly prone to very large population changes as there were only 6 burrows in use along this stretch of cliffs in 1984 following the 1982/83 population crash. At Winterton on Aug 19th 3,600 per hour moving south between 10am-1pm. Latest record Holme Oct 24th.

Swallow: Very early migrants Thornham March 11th, Holme March 12th and Cley March 19th. More widespread arrivals March 26th onwards. Late records in November from Bacton and West Somerton 17th, Horsey 18th and Cley 20th.

Red-rumped Swallow: Winterton Nov 4th (PC).

House Martin: March records from Taverham 18th, Cley 20th, Holme and Warham 26th, Snettisham 27th, Swanton Abbott 30th and West Acre 31st. Last recorded in November at Heacham 9th, Cley 10th and 3 Winterton 11th.

Richard's Pipit: In spring inland at Gillingham Marshes March 30th/April 1st (TA) and Blakeney Point April 30th (AMS *et al*). Autumn records from Weybourne Sept 13th/14th (DHS, KBS, JW), Oct 4th and 27th (KBS), Salthouse Nov 1st-6th (many observers). Cley Oct 25th/26th (HPM, AA) and Blakeney Point Oct 4th and 15th (SCJ).

Tawny Pipit: In spring 2 at West Runton April 30th, one remaining until May 3rd (MPL, SCV *et al*) and another May 16th (MPL), Horsey May 1st (JA, MF), Wells (East Hills) May 7th (BRS) and Blakeney Point May 16th-26th (many observers). One autumn record: a moulting adult at Snettisham July 18th-Sept 24th (TJD, PF, RAI *et al*).

Red-throated Pipit: Blakeney Point May 13th-16th (RD, MIE, AMS *et al*).

Rock Pipit: Birds of *littoralis* race identified at Paston March 27th and on the late date of May 11th, Cley March 3rd and 24th with 2 March 29th and one April 1st, Sheringham 2 March 6th and singles March 7th/8th and 18th with 2 March 24th and one March 27th and Hunstanton March 14th/15th. An individual of typical British race in song at Yarmouth Harbour entrance July 3rd.

Water Pipit: Regularly recorded at Cantley BF where at least 9 in first winter period and 8 in second winter period. Also singles at Surlingham Church Marsh regularly in both periods. At Cley singles March 24th and April 7th-9th with a major influx Oct 26th-Nov 3rd when 13+ present. Elsewhere: Blakeney Point Dec 3rd, Brancaster March 27th, Burnham Norton April 10th, Caister March 25th, Fowlmere Nov 6th, Haddiscoe Island 2 Feb 13th, Holkham April 1st, Holme 2 Sept 28th, Horsey March 7th, Lynn Point Feb 8th-March 26th, Nov 5th and Dec 2nd, Titchwell Feb 26th and 2 Nov 15th and Weybourne March 29th.

Yellow Wagtail: March records from Holme 22nd (2) and 30th/31st, Waxham 26th, Titchwell 27th, Winterton 28th, Welney 29th and Cley 30th. Last recorded Snettisham Oct 17th.

Blue-headed Wagtail: Total of at least 35 spring migrants April 15th-June 4th with maximum of 5 males West Runton April 30th/May 1st. In autumn Wissington BF Sept 1st.

Grey-headed Wagtail: A long-staying male Cley May 1st-28th and another male Weybourne May 15th/16th.

Ashy-headed Wagtail: A male showing the characteristics of this sub-species at West Runton with other *flava* wagtails April 30th (JDG).

Grey Wagtail: Successful breeding noted at Elsing, Great Ryburgh, Gressenhall Mill, Lyng Bridge, Narborough and West Acre. Pairs also in breeding season at Buckenham Mill, Keswick Mill, Norwich (Earlham Bridge), Santon Downham, Sparham Mill and Thetford.

Pied Wagtail: At Whitlingham Marsh roost near Norwich up to 60 in March, 85 July 16th increasing to 615 Sept 2nd and then decreasing to 410 by Oct 14th. Another large count of 200 Dec 21st in the Rhone-Poulenc factory, Norwich where a winter roost has been in use for several years.

White Wagtail: Early migrants Weybourne March 9th, Hunstanton March 10th and 3 Cley March 12th. Largest spring count 15 Weybourne March 27th.

Waxwing: In first winter period singles at Weybourne Jan 10th, Hindringham Jan 20th, Narborough Jan 22nd, Eaton Jan 27th, Sheringham March 9th, Sharrington April 19th

and 2 Cawston April 25th/26th. A minor influx late December with singles Cromer 29th and another 30th, Holkham 29th and 8 on 31st, Blakeney 30th and another flying over same day, 2 Holt 30th and 2 Briston 31st.

Dipper: One of the Northern race (Black-bellied) at Lyng, present since Nov 21st 1988, remained until March 27th.

A bird of British race at Earlham Park, Norwich on the unusual date of June 15th (LAF).

Thrush Nightingale: A singing male at Walsey Hills, Cley May 20th-22nd (M&TB, AMB, ES *et al*). Recorded for the third year running yet only the fourth county record.

Nightingale: Only one coastal spring migrant noted — Blakeney Point May 1st.

Bluethroat: Three typical late spring migrant males: Cley May 25th, Blakeney Point June 3rd and Poringland June 7th (found dead in county primary school grounds). One autumn record, Blakeney Point Sept 12th.

Black Redstart: At Heacham 2 separate birds Jan 30th, one remaining until March 14th: also one Weybourne Feb 26th. Only small spring passage with exceptionally 12 Blakeney Point April 18th. In breeding season only recorded at Yarmouth where 7 singing males and breeding confirmed at 3 sites. Usual autumn movements, but only on a small scale. One again Heacham Dec 15th until year end and another Paston Dec 16th.

Redstart: First recorded at Roydon Common and Thornham April 10th. In breeding season records from various sites in Battle Area, from Sandringham Woods and Swanton Novers Great Wood. Notable fall mid-September all round coast with maxima of 40 Blakeney Point and 50 Holme on 12th.

A first winter male of the race *samamisicus* at Holkham Meals Sept 12th (JBK). The second county record of this distinctive SW Asian race.

Whinchat: Present in breeding season in Brecks at Stanford and Tommy's Belt. Sept 12th 60 Blakeney Point and 30 Holme; next day 34 Horsey-Sea Palling. On 17th still 30 in a sugar-beet field at Gimingham.

Stonechat: In early part of year up to 4 in Yare Valley and up to 6 at Holme. Five successful breeding pairs along east coast. Usual small arrival of ones/twos along north coast Oct/Nov with up to 5 at Weybourne in Dec.

Siberian Stonechat: A first-winter bird Holkham Meals Sept 10th-17th (RG *et al*).

Wheatear: Very early arrivals at Weybourne March 6th and Stanford next day. Records from several localities March 11th/12th. Away from Brecks breeding noted at Paston; downy young also seen in Cley area. November records from Bexwell 1st-3rd, Winterton 3rd, Holkham 4th, Blakeney Point 5th and Snettisham 9th-12th and then found dead.

Pied Wheatear: A male at Winterton Sept 13th/14th (TRD *et al*). The fifth county record and an unusually early autumn date. The first county occurrence (28th May 1978) was

at exactly the same locality.

Rock Thrush: A male at Waxham April 30th (JRW *et al*). The second county record, the first being at Salthouse Heath similarly for one day only in May 1969.

Ring Ouzel: Following a very early migrant at Wereham March 5th/6th, a widespread and prolonged spring passage March 20th-May 29th with maximum counts in April as follows:— 13 Cromer GC 11th; 16 Blakeney Point 13th, 18 Waxham 19th, 11 Holme 19th, 14 West Acre 21st, 15 Holkham/Overy Dunes 22nd and 11 Winterton 24th. At Holme recorded on a total of 30 days between March 27th and May 15th. Males in song at Winterton April 29th and Yarmouth April 30th. In autumn one Holme Oct 7th followed by a total of only 12 Oct 27th-Nov 1st including 5 Blakeney Point on former date. Late migrants at Burnham Norton Nov 17th and Weybourne (2) Nov 25th.

Fieldfare: June records from Holme 1st, Weybourne 8th and Morston and Warham 10th. First returning migrants Holme Sept 10th with 2 next day Holkham Meals. Only very small-scale autumn immigration apart from larger movements over Wash mid-October.

Redwing: Extreme dates Berney May 2nd and Holme Sept 10th.

Mistle Thrush: At West Bilney flocks of 40 mid-February and 50 Sept 17th.

Cetti's Warbler: A large number of singing males in spring: Brundall, Buckenham/Cantley, Hardley, Horning Waterworks, Hoveton, How Hill to Sutton Broad (3), Irstead, Postwick, Ranworth 2, Rockland Broad to Surlingham 12, Strumpshaw 5, Thorpe St. Andrew, Whitlingham and Woodbastwick 2.

Away from the traditional Yare Valley and Broadland sites a pair almost certainly bred at a site on the North coast and a single at Holme March 30th.

Grasshopper Warbler: Earliest date Cley April 9th and by 25th seven singing males there. Autumn migrants Blakeney Point Sept 10th and Wells Sept 11th/12th.

River Warbler: Boughton Fen: a well-watched bird July 8th to 21st (PB PC *et al*). The second county record.

Savi's Warbler: First at Hickling April 19th and thereafter 4 singing males summered. Elsewhere singing birds at Catfield, Martham, Ranworth and Waxham.

Sedge Warbler: An influx in the closing days of March, the first at Holme and Titchwell on 28th. Latest: Holme Oct 5th.

Reed Warbler: At least 12 presumed migrants Horsey Sept 13th.

Icterine Warbler: Singing bird at Cromer May 23rd. In autumn: Caister Sept 11th; Holkham Meals Aug 27th/28th, Sept 1st, 2 Sept 10th/11th, one on 12th, 2 on 13th and one on 14th and Hunstanton GC Sept 10th.

Subalpine Warbler: Weybourne: A female or 1st summer male May 3rd (MPT JW *et al*). The eighth county occurrence.

Barred Warbler: Recorded as follows: Caister Sept 15th/16th; Winterton Aug 20th and Sept 18th; Northrepps Aug 28th-Sept 2nd; Weybourne Sept 11th-14th; Blakeney Point Aug 19th, Sept 6th and 12th; Holkham Meals Aug 28th, 1-2 Sept 10th-18th and singles Oct 20th and 26th; Holme Aug 28th; Hunstanton GC Sept 10th and Hunstanton Sept 12th/13th.

Lesser Whitethroat: First reported at Waxham, Beechamwell and Hoe all April 16th; 12 Blakeney Point April 30th. In autumn 10 Horsey Corner Sept 13th and a late bird at Wiveton Nov 19th onwards was of the British race.

Whitethroat: First Weybourne April 15th.

Garden Warbler: Peak migrant counts: 12 Horsey Corner Sept 13th and 17 Holme Oct 17th. A late bird at Holme Nov 5th.

Blackcap: A male regularly visited a Pudding Norton bird-table Feb 6th-14th. Dec records: Downham Market, Holkham, Holme 2, Swaffham 2 and Winterton.

Greenish Warbler: 1987 Blakeney Point records should read 'One Aug 25th/26th, 2 on 27th/28th with one remaining till 30th'.

Pallas's Warbler: Blakeney Point Oct 15th/16th (GED PF SCJ AMS NW), Weybourne Oct 18th (KBS), Holkham Meals Oct 21st/22nd (ICW MKN KAN *et al*) and 27th (AB) and Waxham Nov 12th-14th (JRW NWW *et al*).

Yellow-browed Warbler: Another excellent set of observations with a minimum of 31 individuals: Yarmouth Oct 3rd, 3 on 4th with one till 7th, Oct 11th and 29th; Winterton Oct 16th/17th and Nov 2nd; Waxham Sept 24th, 25th, 29th and Oct 6th-8th; Hickling (Whiteslea) Sept 16th; Sheringham Oct 4th; Weybourne Oct 3rd-5th; Stiffkey Oct 4th, 2 on 6th/7th; Wells (East Hills) Oct 6th/7th; Holkham Meals 5 Oct 4th, 3 on 5th, 3 on 6th, 6 on 7th, 3 on 8th, one on 9th, 2 on 10th, 2 on 14th, 4 on 15th with one remaining at Wells until 22nd and one at Holkham till Nov 2nd; Wells Town Oct 6th-13th with 2 on 8th; Holkham Park 2 Oct 15th with one till 18th; Titchwell Oct 7th and Holme Oct 4th-6th. A late bird at Winterton Dec 1st-8th showed all the characteristics of the south-west Asian race *humei* (PC AMS AL PJH *et al*).

Dusky Warbler: Blakeney Point Nov 12th (SCJ *et al*).

Additional 1985: Holkham Meals May 21st-23rd (PMC *et al*).

Bonelli's Warbler: Holkham Meals: Sept 10th-17th (RFR CKTH *et al*). The eighth county record.

Wood Warbler: Coastal spring migrants at Holkham Gap May 3rd, Titchwell May 9th and Weybourne May 21st. Singing males at Blickling 2, Docking, Holkham Park, Kelling 2, Langham, Sandringham, Sheringham 4 including a breeding pair, Snettisham (Ken Hill), Swanton Novers, Thorpe St. Andrew, Weybourne 2 and Wolferton.

A good number of autumn migrants: Holme Aug 25th; Holkham Meals Aug 30th and

Sept 11th/12th; Yarmouth Sept 10th and 2 Sept 16th; Cley Sept 12th; Wells (East Hills) Sept 10th/11th and Sculthorpe Sept 12th.

Chiffchaff: Recorded in first-winter period at Holkham Meals, Holme, Strumpshaw, Titchwell and Weybourne. Perhaps first spring migrant at Winterton Feb 26th and singing birds widespread by end of first week in March.

Late migrants at Blakeney Point, Waxham, Winterton and Yarmouth until second week in Nov. In second-winter period at Cromer, Holkham Meals, Holme, Paston and Titchwell.

At Weybourne the bird which arrived Nov 2nd 1988 and was ringed shortly afterwards successfully overwintered and remained to breed. This is apparently the first occasion a Chiffchaff has been proved to both winter and breed in Britain and it is remarkable that it should have done so at the same locality. It was reported as *abietinus* in the 1988 NBR, but closer examination showed it to be intermediate between that race and *collybita* (KBS).

Willow Warbler: First on the very early date of March 11th at Salthouse followed by Strumpshaw March 25th and records widespread after 28th. Good numbers of migrants in mid-Sept: 30 Holkham Meals Sept 11th, 30 Blakeney Point and 15 Holme Sept 12th and 40 Horsey Gap-Sea Palling Sept 13th. Many of these showed characters of the Scandinavian race *acredula*.

Three Oct records: Holme 5th, Holkham Meals 14th and Titchwell 22nd.

Goldcrest: Good numbers of autumn coastal migrants: 50 Blakeney Point Sept 12th, 150 Horsey Gap-Sea Palling Sept 13th, 350-400 Holkham Meals Oct 2nd, 400 there and 60 Blakeney Point Oct 8th and 50 Yarmouth Oct 11th.

Firecrest: Spring passage birds (ones and twos) at Blakeney Point, Brancaster Staithe, High Kelling, Holkham Meals, Holme, Horsey, Norwich (Earlham Cemetery), Paston, Sheringham, Strumpshaw, Swanton Novers, Walsey Hills/Cley, Waxham, Welney, Weybourne and Yarmouth.

Autumn birds (again ones and twos) at Blakeney Point, Hemsby, Holkham Meals, Holme, Pentney, Pulham Market, Weybourne, Winterton and Yarmouth. In winter at Sparham Jan 1st-3rd and at Holt Dec 26th.

Spotted Flycatcher: Largest assemblies: 14+ Scolt May 25th and 10+ Yarmouth Sept 16th.

Red-breasted Flycatcher: An excellent autumn: Yarmouth Sept 10th-16th; Caister adult male Sept 13th-17th; Cley Sept 12th; Blakeney Point Sept 10th with 2 on 11th and 5 on 12th; Wells East Hills 5 Sept 10th/11th; Holkham Meals Sept 10th-13th, Sept 29th-Oct 2nd, Oct 7th, Oct 8th and Oct 18th till at least 22nd with 2 present on 19th and Thornham Point Sept 12th/13th.

Pied Flycatcher: In spring: Yarmouth May 9th and 12th; Strumpshaw May 24th; Paston May 21st, Cromer May 23rd; Salthouse Heath April 26th; Blakeney Point May 20th and Holme April 16th and May 20th.

In autumn peak numbers Sept 12th including Yarmouth 12, Blakeney Point 60+, Holkham Meals 21 and Holme 40. Inland at Welney Sept 13th and Norwich (Sprowston) Sept 28th. October birds at Yarmouth 3rd/4th, Winterton 5th, Holkham Meals 2nd and Holme 2nd and 5th.

Bearded Tit: Pairs bred at Breydon one, Berney 4, Surlingham Church Marsh one, How Hill 8, Hickling 22, Horsey 10, Woodbastwick 12, Ranworth 10, Cley 10, Burnham Overy Staithe one and King's Lynn BF 2.

Autumn irruption obvious during mid-Oct with 6 leaving Cley Oct 11th, 12 west at Weybourne and 4 south at Winterton on 18th and 17 west at Wiveton on 19th. A wide scatter in winter, largest number (55-65) at Titchwell in Dec.

Long-tailed Tit: Large flock of 73 at Bayfield Feb 2nd.

Red-breasted Nuthatch: This delightful addition to the British List was present at Holkham Meals from Oct 13th into 1990 (RA PV *et al*). See article on page 412.

Golden Oriole: Spring migrants at Holkham May 15th, Burnham Overy May 23rd, Glandford May 24th, Holme May 25th and Kelling 2 June 2nd.

Up to 7 pairs bred in the county; in addition a further 5 pairs summered.

Red-backed Shrike: In spring single migrants at Winterton, Sheringham, Weybourne, Salthouse Heath, Walsey Hills, Blakeney Point, Scolt, Thornham and Holme May 18th-June 24th.

In the Brecks a solitary male returned to Santon Downham May 18th remaining until June 10th.

Good numbers in autumn when 1-3 at Yarmouth, Caister, Winterton, Horsey, Horsey Mere, Weybourne, Salthouse, Blakeney Point, Blakeney, Morston, Wells, Holme and Hunstanton GC.

Great Grey Shrike: During April at Winterton 24th-26th, Weybourne 18th, Cley 20th, Salthouse Heath 21st-25th, Barrow Common 26th and Holme 17th-25th.

In autumn Waxham Oct 19th, Holkham Nov 16th-18th, Holme Sept 11th/12th and East Harling Nov 11th. During the winter at UEA Jan 23rd-Feb 17th and probably the same bird returned to nearby Keswick Mill Dec 10th.

Magpie: Largest roost counts: 70 New Buckenham Common Jan when 110 Roydon Common.

Carrion Crow: Surlingham: 60 collecting to roost March 11th with 100 there Nov 29th. Roydon Common 100 Nov 25th.

Hooded Crow: A bird at Holkham for the second half of Jan with singles at Roydon Common Jan 21st and at Breydon Feb 12th-April 15th. Coastal spring passage March 4th-June 5th; July birds noted at Salthouse and Holme. Single autumn bird at Winterton Nov 19th and 2 at Horsey Dec 27th. A hybrid at Belton and Haddiscoe Island in Feb.

Tree Sparrow: Largest winter flocks: up to 200 Thorpe End Jan-March; 180 Hindringham Jan and 200 Massingham Heath Feb 26th.

Brambling: Spring totals included 30 Salthouse Heath April 17th increasing to 70 24th/25th; 50 Weeting March 25th; 100 Massingham Heath Feb 5th and 150 Gooderstone in late Feb. A late bird Kelling June 9th.

In autumn largest parties were 50 Snettisham Oct 17th and 60 Cley Oct 27th.

Siskin: Winter flocks up to 60 widespread. In addition 120 Sparham Jan 3rd, 150

Narborough Jan 15th, 250 Bodney/Langford Feb 11th and 125 Santon Downham March 30th. During March/April many observations of birds feeding on peanuts in gardens. Bred at Snettisham (Ken Hill), Watton and Swaffham Forest.

Twite: Largest flocks: 700 Brancaster Feb 6th and Nov 24th; 150 Salthouse Nov 3rd and 500 Holkham Bay Nov 7th. Inland at Southery Fen 12 Oct 11th and Welney Nov 15th. Weybourne 60 flew east Oct 23rd.

Mealy Redpoll: All reports in first-winter period with very small numbers (maximum 20) at Choseley, Downham Market, Hickling, Massingham Heath, Rollesby and Titchwell. Larger flocks at Thorpe End (Dussindale) where up to 30 Jan/Feb and Hindringham where up to 50 late Jan.

Arctic Redpoll: Thorpe End (Dussindale) one of the race *exilipes* Jan 25th-March 25th (BWJ *et al*).

Additional 1986: Burnham Deepdale/Scolt Head Jan 26th/27th (RGM RW).

Two-barred Crossbill: Additional 1980: Santon Warren a female June 7th (RW *et al*).

Common Crossbill: Most reports from Santon Downham and Thetford areas. Breeding recorded at Thetford, Sandringham and Kelling. Other reports from Holkham Meals, Wolferton, Fowl Mere, West Tofts and St. Helen's Well.

Coastal records: Cromer GC June 11th; Weybourne 2 east Jan 28th and 2 west July 3rd; Gun Hill 9 east May 22nd; Holme March 27th and Snettisham March 26th.

Scarlet Rosefinch: Holme Sept 13th and 17th (MJAB GFH RLKJ JJ).

Hawfinch: Bred at Bayfield, Kelling (2 pairs raising 3/4 young each), Saham Toney and at Sandringham. Largest flocks at Costessey where 11 at pre-roost gathering Feb 8th and 12 Ringland Hills Feb 19th. Otherwise reported from Alderford, Bayfield, Brooke, Eaton, Harpley, Holkham Park, Holkham Meals, Home Mere, Lynford, Newton Flotman, Norwich (Earlham Cemetery), Salthouse Heath, Sandringham, Thompson Water, Thorpe St. Andrew and Yarmouth.

Lapland Bunting: Small numbers at regular coastal sites during both winter periods: Beighton Marshes, Belton, Breydon, Cley, Choseley, Haddiscoe Island, Halvergate, Holkham, Horsey, Salthouse, Snettisham, Waxham, Wells, Weybourne and Winterton.

Latest in spring: a male Blakeney Point May 14th. First in autumn: Snettisham Sept 9th. Largest numbers: up to 43 Burnham Norton in Jan. An inland example at Welney

The Red-breasted Nuthatch which tantalised many observers at Holkham Meals. The same locality attracted this Indigo Bunting in 1988. This Tawny Pipit made a prolonged stay at Snettisham.

Sparrowhawks have made a remarkable come-back. Barn Owls remain under threat in many areas following the loss of nesting sites in old buildings and hollow trees.

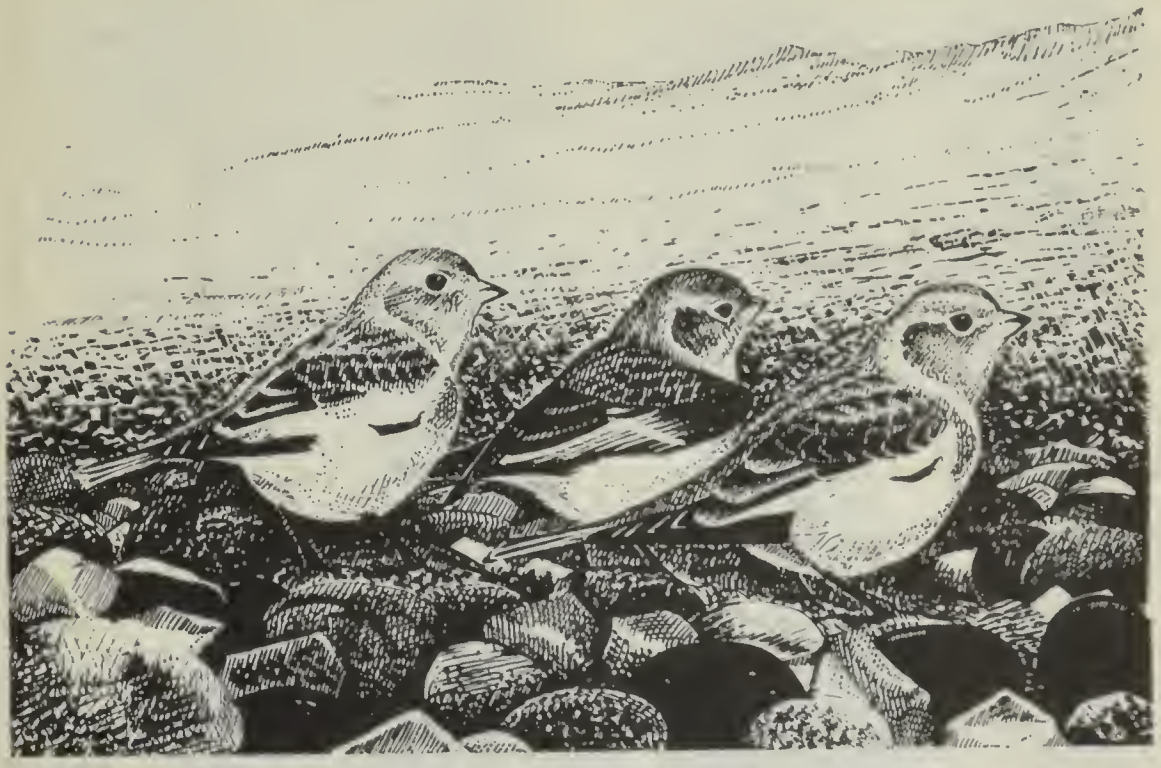
This Broad-billed Sandpiper provided good viewing at Holme. The Night Heron visited Welney Wildfowl Refuge. Overstrand attracted this Mediterranean Gull for the greater part of 1989.

Nowadays Red Squirrels are almost confined to Thetford Forest, but Grey Squirrels have become widespread road casualties. Sightings of Harvest Mice and discoveries of their nests are always welcome

Dec 4th.

Snow Bunting: Largest flocks: 150 Blakeney Point Jan 17th, 200 Salthouse Feb 10th, 200 Holme Nov 17th and 250 Holkham Bay Nov 19th. Late spring birds at Berney where one remained all April and Breydon April 29th. In addition a female at Cley June 5th-9th.

First in autumn at Cley (2 Sept 18th). Inland: Coston Oct 22nd, Bexwell Oct 31st/Nov 1st, Weeting Nov 22nd and Elsing Dec 3rd.



Yellowhammer: Salthouse: A creamy-yellow leucistic individual Oct 1st.

Ortolan: Horsey Mill: a female May 15th/16th (AVH LM ER RDS *et al*).

Little Bunting: Yarmouth Sept 9th/10th (KRD *et al*). Oct 4th (GW) and Oct 15th (GMC).

Corn Bunting: Largest flocks: 50 Berney March 2nd-7th, 43 Crimplesham Feb 3rd, 35 Hilgay Fen May 13th, 50 Lynn Point mid-March, 30 Ten-mile Bank Feb 22nd, 45 Thornham April 13th and 40 Titchwell Feb/March.

Spring/Summer records (many of singing males): Boughton, Choseley, Downham Market, Fincham, Hilgay, Lakenheath Flash, Langham, Marham, Methwold Hythe, Morston, Pentney, Ringstead, Setchey, Shipdham, Snettisham, Thornham, Wereham, Weybourne and Winterton.

CONTRIBUTORS TO THE BIRD REPORT

S. ABBOTT
R. ABERDEIN
T. ABREHART
P. ADDISON
MR. & MRS. R. ALEY
P. R. ALLARD
G. ALLISON
N. AMIES
G. ANDREWS
R. ANDREWS
DR. C. E. ANSON
C. APPLETON
J. R. APPLETON
D. ARCHER
T. ARCHER
T. E. ARCHER
M. ASKEW
MISS L. BACON
C. & P. BAINES
T. BAKER
P. R. BANHAM
S. BANKS
P. BANWELL
A. S. C. BARKER
T. R. BARKER
M. J. BARRETT
J. BAXTER
H. BELL
MRS. J. BENNET
A. J. BENTON
A. R. BENTON
M. & T. BENTON
S. BETTS
MISS J. R. BINSTEAD
J. BISHOP
M. BLACKBURN
B. BLAND
A. I. BLOOMFIELD
E. F. BOOSEY
A. D. BOOTE
T. E. BOULTON
C. G. R. BOWDEN
W. BOYD
MRS. M. A. BREWSTER
D. BRIDGES
J. P. BRISTOW
G. BROOKING
A. M. BROWN
J. BROWN
N. H. BRUMMAGE
D. BRYANT
A. L. BULL
B. BURTON
J. F. BUTCHER
L. BUTLER
J. J. BUXTON
C. BYERS

J. CADBURY
T. CALLAWAY
C. CAMPBELL
H. CARMICHAEL
G. CARR
M. S. CAVANAGH
G. J. CAVEY
J. A. CAVEY
P. CAWLEY
P. CHILLINGWORTH
J. G. CHIPPERFIELD
R. CHITTENDEN
R. G. CLARK
K. CLARKE
MISS L. D. CLARKE
P. R. CLARKE
P. CLEMENTS
P. M. COCKER
A. S. COOK
T. P. COWLEY
G. M. CRESSWELL
E. CROSS
A. CURL
J. CURSON
P. J. DAVIDSON
T. C. DAVIES
T. DAVISON
R. DAWSON
T. R. DEAN
C. H. DOBBS
P. J. DOLTON
C. DONNER
D. A. DORLING
G. DORMER
O. G. DOUGLAS
A. DRIVER
G. E. DUNMORE
K. R. DYE
G. M. S. EASY
J. C. EATON
M. I. ELDRIDGE
M. ELLIOTT
H. ELLIS
DR. K. P. ELSBY
M. ETHERIDGE
L. G. R. EVANS
V. EVE
P. F. FAIRMAN
R. FARNDON
F. J. L. FARROW
P. FEAKES
R. FILBY
P. FISHER
M FISZER
L. A. FOYSTER
R. A. FOYSTER
S. J. M. GANTLETT

R. W. H. GARNER
J. D. GEESON
MRS. J. E. GEESON
N. GIBBONS
D. J. GIRLING
T. M. GIRLING
P. A. GLUTH
J. GOLDSMITH
C. GOSLING
S. A. GRAHAM
R. GRIBBLE
R. GRIMMETT
A. HALE
P. HALE
L. J. HALL
L. T. HALL
M. C. HALL
J. HAMPSHIRE
R. HANCY
A. V. HARDING
B. D. HARDING
A. F. HARRIS
S. HARRIS
K. HASTINGS
R. B. HASTINGS
D. HATTON
M. I. HAYES
P. V. HAYMAN
P. J. HEATH
D. HENSHILWOOD
D. W. T. HERINGTON
MRS. D. J. HERLIHY
D. HERRIEVEN
G. F. HIBBERD
P. HILL
C. K. T. HOCKING
D. W. HOLDEN
D. J. HOLMAN
D. A. HOLMES
J. HOLYOAK
T. HOWES
MRS. L. HUTCHINSON
R. A. IMAGE
P. F. INNES-HILL
R. JAMES
B. W. JARVIS
P. JEFFERY
C. J. JENNINGS
R. JENNINGS
G. JESSUP
I. G. JOHNSON
J. JOHNSON
J. JOLLIFFE
R. L. K. JOLLIFFE
MISS A. JONES
R. JONES
S. C. JOYNER

G. JUDD
S. JUDD
P. KEARNEY
G. I. KELLY
J. B. KEMP
R. KEY
DR. I. F. KEYMER
MRS. J. KEYMER
C. R. KIGHTLEY
P. D. KIRBY
C. A. E. KIRTLAND
C. R. KNIGHTS
MRS. R. J. KNIGHTS
C. LANSDELL
J. R. LANSDELL
A. J. LAST
J. M. LAST
J. LAWSON
V. J. LEA
DR. R. M. LEANEY
M. P. LEE
D. LESTER
A. LEWIS
DR. J. LINES
S. E. LINSELL
C. R. LINTOTT
S. M. LISTER
N. A. LITTLEWOOD
DR. P. J. LOCK
P. LOCKWOOD
D. LOWE
R. S. LUCKING
P. McANULTY
R. McINTYRE
S. McINTYRE
J. D. MAGEE
MRS E. MAKINS
R. MARTINS
P. MASON
D. MAYES
J. R. McCALLUM
R. McCURLEY
D McNIVEN
H. P. MEDHURST
M. MEDHURST
MR. & MRS. J. S. MIGHELL
P. MILES
V. MILES
P. MILFORD
J. MILLER
R. G. MILLINGTON
C. MITCHELL
J. MOLE
R. MONTEITH
B. MOORE
L. MORGAN
P. MORRIS

CONTRIBUTORS TO THE BIRD REPORT (continued)

B. MURPHY
E. T. MYERS
M. NASH
National Trust
K. A. NAYLOR
M. K. NAYLOR
J. L. NEWMAN
P. NEWPORT
T. NIGHTINGALE
P. C. NOAKS
Norfolk Young Nats
D. NORTH
D. J. ODELL
D. OVENDEN
G. R. OXBOROUGH
A. E. PARKER
J. PARROTT
M. PARSLOW-OTSU
J. H. PASK
A. PEARCE
DR. M. PETCH
S. PLANT
S. J. PORTSMOUTH
A. J. PRATER
R. PRESTON
J. L. RAINCOCK
M. RAINS
H. RAMSAY
M. S. READ
P. A. G. READ
R. G. READ
R. F. READER
E. REED
P. J. RILEY
A. RISEBOROUGH
C. ROBSON
M. E. S. ROONEY
S. ROPER
R.S.P.B.
A. & B. RUMSEY
F. RUSSELL
M. D. RUSSELL
W. RUTHERFORD
D. H. SADLER
K. SAUL
MR. & MRS. M. SAUNT
C. SAYER
B. R. SCAMPION
M. J. SEAGO
J. R. SELF
K. W. SELF
R. SHEARING
K. B. SHEPHERD
L. SHERWOOD
T. SILCOCKS
N. SILLS
R. Q. SKEEN
C. SLATER
MR. & MRS. C. J. SMALL
C. SMITH
J. P. SMITH
S. SOUTH
R. SOUTHWOOD
R. A. SPAIN
E. STANFORD
Stanford TRG Area Bird Group
R. STARLING
R. D. STEELE
M. STEWARD
A. M. STODDART
L. C. STREET
MRS. S. STREET
J. SWEENEY
D. TALKS
G. TAYLOR
DR. M. P. TAYLOR
DR. T. TERRY
Thetford Nat. Hist. Soc.
J. THOMAS
W. THROWER
P. VARNEY
H. VAUGHAN
A. E. VINE
R. VOTIER
S. C. VOTIER
R. WADDINGTON
C. WADE
R. WALDEN
R. J. WALKER
MR. & MRS. H. W. WALLIS
I. WALLIS
J. WALLIS
R. WALTON
R. M. WARD
R. B. WARREN
K. WARRINGTON
D. WEAVER
MRS. P. A. WEBB
S. WEBB
B. WEBSTER
A. WEIR
MRS. D. WELLS
J. WHELDON
G. WHITE
I. WHITE
J. A. WHITE
M. L. WHITE
R. J. WHITE
S. WHITEFORD
I. C. WHITEHOUSE
J. R. WHITELEGG
N. W. WHITELEGG
Wildfowl & Wetlands Trust
N. WILLIAMS
J. R. WILLIAMSON
I WILSON
B. WINGROVE
MRS. B. WOOD
M. WOOD
T. WRIGHT
R. C. WYATT

Photographs: Little Bunting, Northern Golden Plover, Dotterel, Tawny Pipit, Broad-billed Sandpiper, Night Heron and Mediterranean Gull (*R. Chittenden*); Red-breasted Nuthatch (*D. M. Cottridge*); Pacific Golden Plover (*A. Greensmith*); Shelduck (*A. L. Howes*); Pallas's Warbler (*B. W. Jarvis*); Bittern (*R. Jones*); Pink-footed Geese (both plates), River Warbler, Sparrowhawk, Harvest Mouse and Hares (*C. R. Knights*); Kingfisher, Barn Owl, Red Squirrel, Grey Squirrel and Mink (*R. Powley*).

Line Drawings: 425 Shoveler and Gadwall, 427 Wigeon, 430 Barn Owl, 448 Leach's Petrels, 449 Little Egret, 458 Golden Plover and Lapwing and 461 Bar-tailed Godwits and Grey Plovers (*N. Arlott*); 414 Pink-footed Geese (*N. Borrow*); 456 Cranes and Hen Harrier, 465 Iceland Gull and 473 Red-breasted Flycatcher (*D. Bryant*); 439 Hawfinch (*C. Donner*); 412 Red-breasted Nuthatch (*E. A. Fisher*); 436 Yellow-browed Bunting (*J. B. Kemp*); 452 Long-tailed Duck, 459 Semipalmated Sandpiper and 463 Pomarine Skua (*C. Lansdell*); 482 Noctule Bat, 483 Mink and 490 House Mice (*J. Last*); 474 Red-breasted Nuthatch (*J. R. McCallum*); 432 Woodlark (*R. Millington*); 446 Black-throated Divers, 474 Golden Oriole and 479 Snow Buntings (*R. Powley*); 447 Sooty Shearwater, 451 Brent Geese and Brant Goose, 453 Ruddy Duck and 467 Nightjar (*M. Read*); 411 Black-tailed Godwit and Spoonbill, 444 Quail, 445 Black-tailed Godwit and Marsh Harrier and 478 Black-tailed Godwit and Heron (*the late R. A. Richardson*); 448 Manx Shearwaters, 454 Hen Harriers, 455 Hobby, 475 Red-backed Shrike, 476 Siskins and 477 Snow Buntings (*J. P. Smith*) and 421 Yellow-browed Warbler, 469 Red-throated Pipit, 470 Pied Wheatear, 471 Rock Thrush, 472 Pallas's Warbler and 477 Little Bunting (*A. M. Stoddart*).

NORFOLK MAMMAL REPORT 1989

Editorial

The Editor is pleased to present the 34th annual Norfolk Mammal Report.

We are again fortunate to be able to publish more than one feature article, but this does put great pressure on available space. So the decision has been made to combine the usual Editorial/Classified Notes. This means that the wealth of background information and anecdotes submitted appear to have been given very short shrift. We emphasise they are all stored and will be combined with next year's contributions to give us extended Classified Notes in our next edition.

No great headline-grabbing events in the mammal world in Norfolk during 1989 we are relieved to say. What the new stabilised level of common seal population will be is still speculation. It is not realistic to expect to see the herds we remember. We made a serious slip last year in allowing the harp seal found very recently dead in Blakeney harbour on 27th March 1988 to go unlisted. This vagrant from the north has appeared no more than a dozen times in the UK for over a century but in 1988 two were recorded. This compares with the thousands trapped in fishing nets off Norway. We apologise for this omission, as we do for any other errors in this or any other report.

Our main feature article, by Simon Baker, fills a significant gap in our published data on Norfolk mammals. It brings together all information on the American mink and because mammals have no regard for boundaries, the article covers our whole region. Clive Slater's article on rat and mouse infestation in north-east Norfolk in 1987, held over for lack of space, is included in this year's report. Although the data was collected some time ago, we feel it is of significance and should be published.

The bats form a considerable proportion of the mammal list and from time to time John Goldsmith brings us up to date on their status. He does so again in a short article.

Moving on to other orders, the Insectivora were well represented by hedgehogs in every month of the year, though minute late-brooded youngsters in December did not always respond to devoted human care and often died. Adults, however, were seen and appeared to be in good condition. Yet the general impression was that fewer hedgehogs were noted in many districts. It may be the dry summer and poor invertebrate fauna when the ground vegetation was less than perfect had its effect. Certainly, the shrews were not as well represented in the contributed lists. They of course, are entirely dependent on a plentiful supply of invertebrate food. In contrast, moles could well claim to be our most widespread and successful mammal. We refute any gardener's claim to house our entire stock! The insectivore giving cause for concern is the water shrew. After such a good year in 1988 when far more were seen than for many previous seasons, 1989 produced only two records, one from Reedham Marshes and the other from Upton Fen. This animal's intriguing behaviour as it swims under water, its fur shimmering with bubbles of trapped air, should surely be enough to make even the unknowing observer ask after its name and in so doing report its presence.

As for the Lagomorpha, the brown hare was seen more frequently in Breckland and

in many areas along the north coast and in open areas of central Norfolk. Rabbits were much in the news. The scheme to use them as agents of land management on Weeting Heath to preserve Breckland species will be watched with interest. The other scheme to move the colony at the University of East Anglia in order to use the site of their warren for new buildings has been hotly contested as a profound setback to vital research.

The seemingly ubiquitous representative of the Rodentia, the grey squirrel, was responsible for its now regular damage. A number of contributors suggested a slight retrenchment in numbers but there was no real significant fall. Now that the Forestry Commission has inaugurated the new Forest Park at Thetford and taken the red squirrel as its symbol we trust that indiginous species will continue to prosper in those plantations. At the moment it seems to be in a healthy state.

Stories of bank voles feeding in gardens must wait till next year. They appear to have had a good year as did the short-tailed field vole. 'More than last year but generally fewer', so says a correspondent comparing the short term and the long. Water voles were seen in most parts of the county in reduced numbers. Has there been a slip back in its recovery? Lack of water in the ponds was suggested as one reason. Two references only came from one south Norfolk site where they were once plentiful. On a happier note the number of harvest mice found in west Norfolk stack yards by one contributor was astonishing.

The coypu clings to its tenuous hold on our list even if it may no longer be found living in the county. Dr. Morris Gosling, Coypu Research Laboratory, who through the years has kept us so well informed, writes:

'Field staff from the ADAS Coypu Research Laboratory continued to carry out systematic surveys throughout 1989 to check if any coypus remained after the recent eradication campaign. In addition we followed up a number of reports of coypus from members of the public. In most cases the culprits proved to be other mammals, often rats or water voles, and the unusual appearance of rabbits infected with myxomatosis may also have stimulated one or two reports. However, at the end of November a sharp-eyed member of the public reported seeing a coypu near Feltwell in west Norfolk. This was confirmed on the following day by a member of our field team and after a few weeks of intensive trapping a coypu was caught on the 20th of December. Like the two animals killed on the roads in 1988 it proved to be an old male and extensive surveys in the area failed to reveal evidence of any other coypus.

Three animals have thus been confirmed since the last small colony was removed by Coypu Control trappers on the River Great Ouse in April 1987, almost three years ago at the time of writing in April 1990. All three were isolated individuals and as time goes on it becomes increasingly unlikely that any breeding colonies remain. As a result, the systematic surveys carried out by staff from the Coypu Research Laboratory stopped at the end of March 1990 and the two permanent staff involved in this work have been transferred to other duties within the Ministry of Agriculture. Of course this does not mean that no coypus remain — this will not be known for certain for some years — and responsibility for following up any reports of coypus from members of the public have been transferred to the Ministry of Agriculture's Wildlife and Storage Biology Group (telephone 0223 462762).'

Extreme contrasts in the Carnivora in that foxes are over-plentiful, while otters and badgers continue only with special assistance. Stoats and weasels are reasonably represented where habitat is suitable. The number of stoats in ermine has been surprising. Any reports are very welcome as we may need to look more closely at the cause of this phenomenon.

After last year's full account of Artiodactyla we need only to say that the red, roe, chinese water and muntjac deer were well represented on our index cards. Far fewer contributors actually saw fallow deer.

So it was with Cetaceans. It is now a rare event to note more than a single or a very

small party. Common porpoises were seen from Winterton, Weybourne, Salthouse, Paston, Scolt Head and Cley, which gave most returns.

Work on the distribution maps of Norfolk mammals continues and we intend to publish more as space permits. This is the cue for our annual reminder that every record counts and we do need far more detail if these maps are to have real significance. We cannot emphasise too often or too strongly that even the common-place is worth recording. After all, have we any guarantee it will remain so?

We thank all our contributors especially John Last for vignettes. Without their efforts this report could not exist. Notes for the next report should be sent to Rex Hancy, Ardea, 124 Fakenham Road, Taverham, Norwich NR8 6QH by the end of January 1991. We do have specially prepared recording sheets available from the Natural History Department at Norwich Castle Museum. John Goldsmith on Norwich 611277 Extension 286 will be happy to pass them on. He continues to answer queries on all vertebrate fauna.

CONTRIBUTORS TO THE MAMMAL REPORT

J. APPLETON
S. BAKER
DR. D. BELL
I. BEGGS
S. BETTS
D. BILLMAN
E. BOOSEY
J. BREWSTER
M. A. BREWSTER
T. BROWN
A. BULL
P. BURROUGHES
J. BUTCHER
J. BUXTON
C. CAMPBELL
M. S. CAVANAGH
M. CLARKE
E. CROSS
J. A. & J. H. DAWSON
D. DIX
D. G. DOUGLAS
Eastern Counties Newspapers
J. P. ELLERO
H. FAIRHEAD
F. J. L. FARROW
I. FARROW
D. FINCHAM
H. FINCHAM
T. FUTTER
J. GAFFNEY
J. H. GARNIER
J. & J. GEESON
N. GIBBONS
J. G. GOLDSMITH
DR. L. M. GOSLING
R. HADMAN
J. HAMPSHIRE
R. & B. HANCY
R. HARMER
A. HARRIS
M. I. HAYES
P. HEATH
D. HENSHILWOOD
J. & T. HUMPHRIS
T. IVINS
G. JESSUP
S. G. & E. JUDD
G. KELLY
J. KEMP
DR. I. F. & MRS. J. KEYMER
R. KNIGHTS
J. LEE
D. LESTER
R. H. LEVIEN
J. LUSHER
J. D. MAGEE
H. P. MEDHURST
M. METCALF
B. MURPHY
Nar Valley Ornithologists
C. NEALE
M. NEALE
H. NICKERSON
Norfolk Ornithologists Association
D. & P. PASHLEY
S. PASCOE
MRS. PITKIN
MRS. PILE
B. PODMORE
R. POWLEY
R., P., & E. POLS
J. L. RAINCOCK
M. RAMSAY
M. RAWLINGS
F. P. J. REYNOLDS
D. I. & R. M. RICHMOND
K. RIVETT
E. ROGERS
F. RUSSELL
M. D. RUSSELL
C. SLATER
C. J. SMALL
D. STEPLEFORD
J. STRINGER
G. TAYLOR
DR. P. TAYLOR
Thetford Natural History Society
H. TOOLEY
P. TRETT
P. TWELL
A. E. VINE
C. WADE
R. WALBY
M. WAITE
N. WRIGHT
Young Ornithologists' Club (Norwich Branch)

Mink in East Anglia

Simon Baker, Mammal Ecology Group, ADAS Central Science Laboratory, Jupiter Road, Norwich, NR6 6SP

Introduction

Mink (*Mustela vison)* are native to much of North America and were imported to Britain to be bred for their fur. The first farms were established in 1929 and escaped animals were soon found in the wild (Lever, 1985). However, the first record of breeding out of captivity was not until 1956, on the River Teign in Devon. In 1965 a trapping campaign was started by the Ministry of Agriculture Fisheries and Food (MAFF) to try and limit the spread of the developing wild population (Thompson, 1971). Nine trappers were employed but by 1970 it was clear that further spread was unavoidable and trapping was discontinued. Records of mink known to have been killed each year to 1967 were kept by MAFF and the results for East Anglia are summarized in Table 1. Mink are now found throughout Britain and are likely to be a permanent addition to our fauna.

Table 1

The number of mink caught in the wild in East Anglia reported to MAFF up to September 1967 (Thompson, 1968).

	pre	1961	1961	1962	1963	1964	1965	1966	1967	Total
Suffolk		3	4	2	6	3	4	2	2	26
Essex		—	—	17	5	—	—	—	2	24
Norfolk		—	—	2	6	2	1	2	1	14
Cambridgeshire		—	—	—	—	2	1	—	—	3
Hertfordshire		—	—	1	—	1	—	—	—	2
Huntingdonshire		—	—	—	—	—	—	1	1	2
Bedfordshire		—	—	—	—	—	—	1	—	1

The more recent Coypu Eradication Campaign has, in contrast, probably been successful in achieving its objective (Gosling, 1989). Incidental captures of mink made during coypu trapping operations has also provided information on mink distribution and abundance. Additional information is available from records held at the Castle Museum in Norwich and from reports made by landowners to the ADAS office in Norwich. These data, together with information on the distribution of mink farms in the region, help illustrate the establishment and status of the species in Norfolk and allow this to be viewed in the context of its status in East Anglia as a whole.

Mink caught during the Campaign to eradicate Coypus

The trapping of mink

Centrally co-ordinated trapping of coypus has been in progress since 1962, when a government sponsored campaign attempted to eradicate coypus from all areas except their 'inner redoubts' in the Broads (Norris, 1967). This campaign continued until 1965. Trapping remained at a low level in the late 1960's and early 1970's but the number of trappers employed then rose to 18 by 1977 and remained at that level until a second eradication campaign was started in April 1981 (Gosling, 1985). This campaign employed 24 trappers and continued until January 1989 when the campaign was judged to have attained its objective and the Coypu Control Organisation, which employed the trappers, was disbanded.

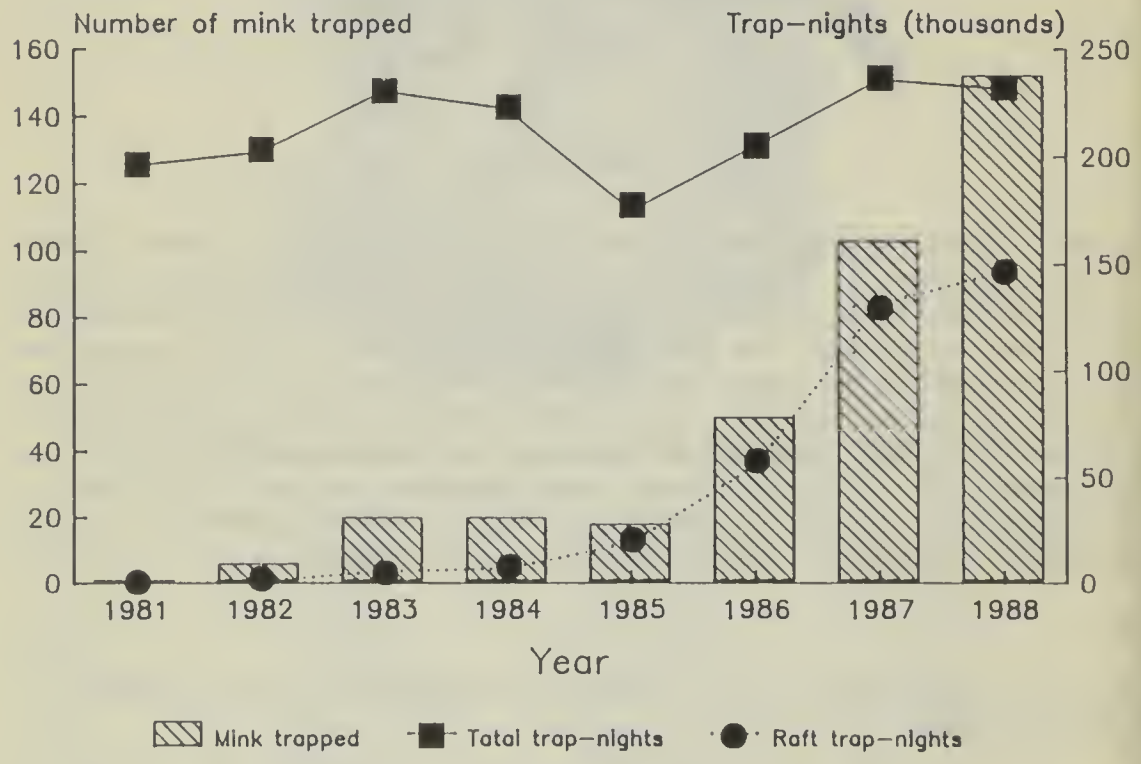


Figure 1. The number of mink caught (n=370), the total number of trap-nights and the number of trap-nights on rafts recorded by Coypu Control trappers each year between 1981 and 1988.

Staff at the ADAS (Agricultural Development & Advisory Service), Coypu Research Laboratory in Norwich monitored and guided the eradication campaign and received weekly records from each trapper detailing where they had been trapping, the number of cage traps set and the number of coypus caught. Although the traps were baited with root crops

and no attempt was made to catch species other than coypus, mink were captured incidentally. From 1981 trappers were instructed to shoot any mink caught and in October 1983 the trappers' weekly recording sheet was modified to include the numbers of mink killed. Relatively few mink were caught prior to 1983 and it is likely that when this occurred it would have been sufficiently noteworthy for a comment to be placed on the weekly record sheet. All records of mink recorded from March 1973, the earliest records available, to the end of 1988 have been used.

One problem in interpreting the data is that trapping effort has not been even over the whole of East Anglia and has varied in intensity at a given site from year to year as trapping effort was redirected in an attempt to maximise the numbers of coypus caught (Gosling and Baker, 1987). Despite this, the trapping results give a reasonable reflection of mink distribution and relative densities because trapping intensity has generally been so great that it would rarely have limited the numbers of mink caught. A recent brief period of trapping near Feltwell in southwest Norfolk, in December 1989, illustrates this well. In all Decembers between 1978 and 1988, 33 mink were caught in 147,460 trap-nights: equivalent to 1 mink per 4,468 trap-nights (a trap-night is one trap set for one night). However, at Feltwell in 1989, six mink were caught in only 1,700 trap-nights: equivalent to 1 mink per 283 trap-nights. Which indicates that mink are readily caught in coypu trapping operations if they are present.

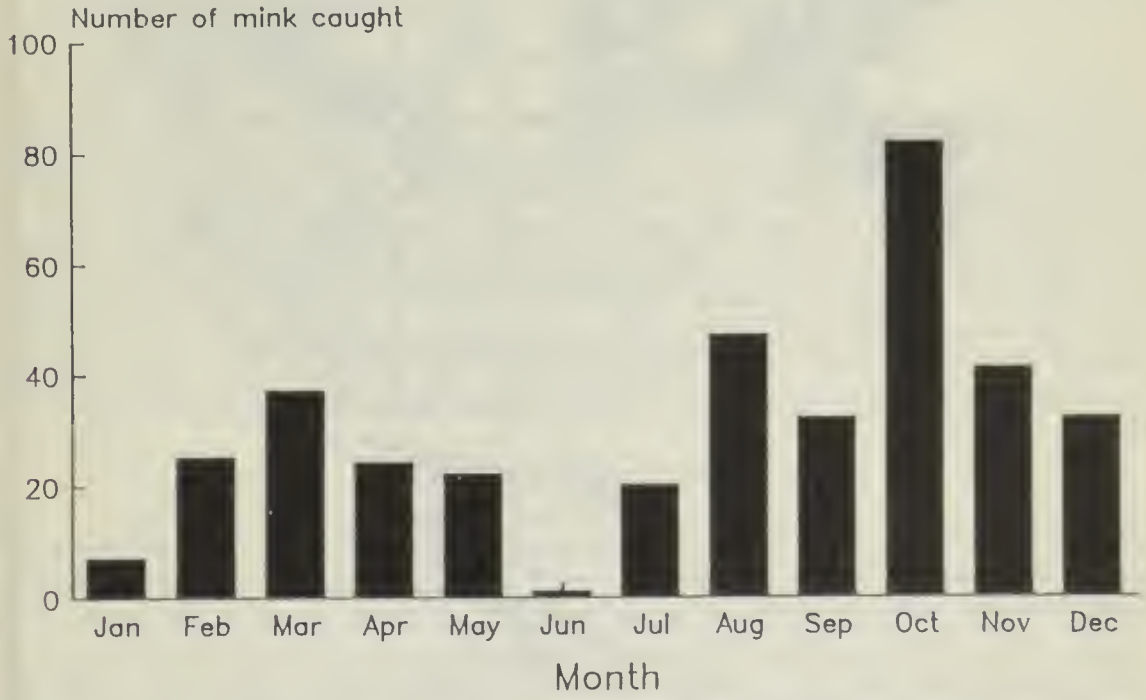


Figure 2. The total number of mink caught each month by Coypu Control trappers between 1978 and 1988 (n=380).

Numbers of mink killed each year

The number of mink caught has risen sharply in recent years. In the eight years prior to 1981 only 10 mink were trapped but by 1988 the annual total had risen to 152 (Figure 1). Part of the increase may be due to an increase in the proportion of traps set on rafts (Figure 1). These have been shown to be more effective at catching coypus than traps set on land and generally catch fewer non-target species other than mink (Baker & Clarke, 1988). The effort put into raft trapping consequently rose during the campaign but the

rate of increase in raft trapping does not follow in detail the increase in mink kills. For instance, between 1983 and 1985 the number of raft traps set rose by 229% but the number of mink caught stayed stable; whilst between 1987 and 1988 the number of raft traps only rose by 12%, whilst the number of mink killed went up by 44%.

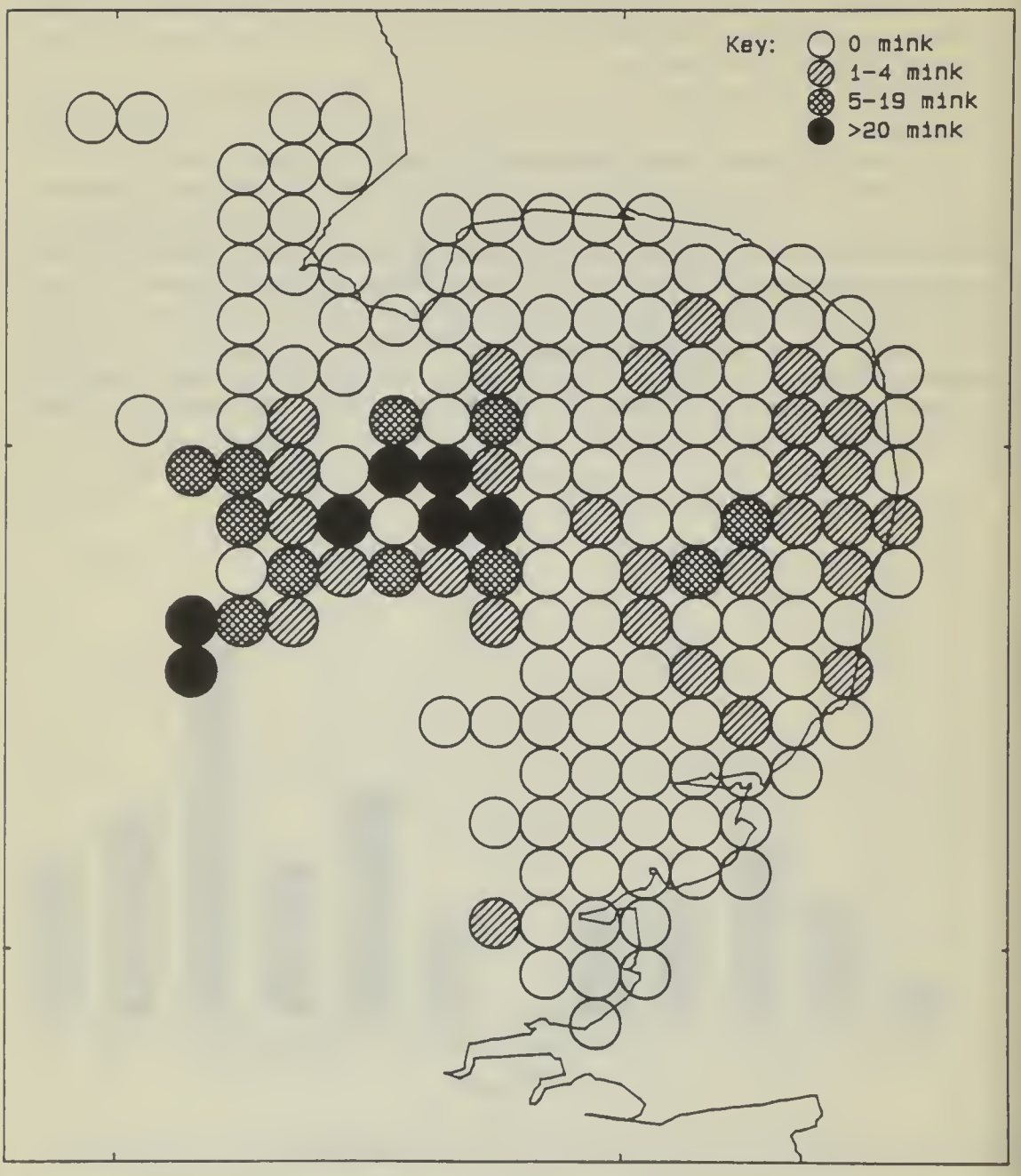


Figure 3. The area over which coypu trapping was carried out between 1981 and 1988 and the number of mink caught per 10 km square. Most, 86%, of the mink were caught in the area shown as lightly shaded; see text for further details.

A more important cause of the overall rise in mink caught is that more trapping has been done in recent years in areas where there are more mink, notably in Cambridgeshire, west Norfolk and along the River Great Ouse. The majority (86%) of all mink caught by Coypu Control were caught in the block of 25 10 km grid squares with mink captures in this area, shown lightly shaded in Figure 3. Little trapping was done here prior to 1983

(<4,000 trap-nights), but this had risen to just over 9,000 trap-nights in 1984 and 1985, 17,000 in 1986 and 41,000 and 39,000 trap-nights in 1987 and 1988 respectively. However, the large increase in the number of mink caught between 1987 and 1988, despite similar trapping effort in the high density area, and only a small increase in raft trapping, indicates a real underlying increase in the population in recent years.

Mink killed per month

The distribution of mink captures during the year (Figure 2) shows two peaks, one in late summer and autumn and a smaller one in the spring. This pattern is similar to that found by Clark (1970) in Yorkshire and Lancashire, except that his peak month was September rather than October. As no bait attractive to mink was used in the coypu traps, the seasonal trend in captures is probably due to changes in mobility. The autumn peak is likely to have resulted from a combination of the dispersal of young animals, the use of more den sites and greater daily travelling by territorial animals at this time of year; as was observed by Birks and Linn (1982) who radio-tracked mink in Devon. Mink mate between February and April and the spring peak may reflect increased movement of animals searching for mates. After a variable delay following mating, the fertilised ova implant in the uterus and the young are born in mid-May, usually some 45-52 days after mating (Stevenson, 1959). June was the month when the least mink were caught, both by coypu trappers and in Clark's (1970) study. Whether this low catchability is directly associated with the presence of young is unclear.

Distribution in East Anglia

The distribution map (Figure 3) shows all 10 km grid squares in which a reasonable amount of trapping occurred (>200 trap-nights) between 1981 and 1988 and the relative numbers of mink caught. In total 370 mink were trapped, the most caught in one square, 38, were caught in grid TL68 which contains the River Little Ouse and its catchment to the west of Lakenheath. In general mink are most common in west Norfolk and west Cambridgeshire; along the Great and Little Ouse rivers and in the agricultural land to the east of the Ouse Washes. They were also found, although less frequently, in the Broads, along the River Waveney and in the extensive areas of grazing marsh in east Norfolk and north Suffolk. The parts of Lincolnshire and Essex where trapping took place appear to have very few mink.

Mink distribution in Norfolk

The first known record of a mink in the wild in Norfolk was an adult female that was shot in a chicken run at Ringland, near Norwich, in August 1957. The distribution of all records for the county are shown in Figure 4. In the case of records from Coypu Control trappers, captures were identified by site and 10 km grid reference. The site was usually the nearest village but sometimes the name of the marsh or even the name of the farm. This information has been used to identify a central 1 km grid square for the site. Where similar information was available for other records this process was repeated and all records for which a one kilometre grid reference could be assigned are presented as tetrads (2 km by 2 km squares) in the distribution map. Inaccuracy caused in assigning grids to sites will be small and would tend to underestimate the true distribution of the species, because kills from large sites would all be assigned to a central square when in reality they would be more dispersed. This effect will be most evident in the agricultural fens in the west of the county where mink are relatively abundant (Figure 3) and villages are widely dispersed. Tetrads where there are records of mink from before 1971 are distinguished as, before the wild population became widely established, a greater proportion of reports are likely to be of animals that have escaped from fur farms.

Mink farming and the establishment of Mink in Norfolk

Little is known of the early days of mink keeping in the region but the first note on the mink record card held at the Castle Museum records ten farms known to Jim Taylor Page in 1961. In 1962 an Order made under the Destructive Imported Animals Act 1932, required mink farms to be licensed and any escapes to be reported. The result was that many farms were unwilling or unable to comply with the new keeping conditions imposed under the Act and the number of farms in Britain fell from over 700 to 300 (Thompson, 1967). By 1987 only 51 farms were licensed (United Kingdom Parliament, 1987), although the number of animals kept, about 100,000, is probably similar to that in 1962.

Figure 4. Tetrads in which wild mink are known to have been present in Norfolk; based on information from Coypu Control, MAFF and Norwich Castle Museum (n=130). Open circles indicate tetrads where mink were recorded prior to 1971.

The events in Norfolk have mirrored those nationally. Although at least ten farms had been present in 1961 only five farms were licensed by 1963 and all these have now stopped trading. Since 1965 four new licences have been granted, one of which was to a wildlife park, and in 1989 only three establishments were licensed. Figure 5 shows the locations where mink are known to have been kept in Norfolk, with open symbols denoting sites where farms were present prior to 1962. As around half of the farms present at that time were not sufficiently viable for their owners to licence them in 1962, it is likely that housing was often of poor quality prior to the introduction of licensing and there were probably many escapes. Only a few escapes have been reported since 1962.

Many animals were recaptured soon after they escaped but it quickly becomes impossible to distinguish wild bred animals from escapees, especially as they can travel long distances after escaping. For example, an unusual 'pink' coloured mink escaped from a farm in Lincolnshire in September 1968 and was caught 20 miles away (assuming it had

taken the most direct route by water) 50 days after its escape (J. Lill, pers. comm.). The problems faced by escapees are often underestimated and many such animals, which have spent the whole of their lives in a small cage, will die of starvation or in an accident in an unfamiliar world. Those that do survive will often not be able to find a mate and ultimately die without issue.

Conclusion

Records of mink killed in East Anglia, shown in Table 1, and other early records from Norfolk (Fig. 4) indicate that mink were widespread, although not abundant, in Norfolk and Suffolk in the 1960's. During succeeding years populations have become established in Norfolk: in the southwest of the county, along the River Waveney and in Broadland. For the reasons outlined above it is uncertain what role the county's mink farms played in this establishment and to what extent it is due to immigration from populations established beyond Norfolk. However, the easterly distribution of farms corresponds with the distribution of most of the early records of wild mink (Fig. 4, open circles), indicating that many of these were probably escapees. Such escapees probably helped mink to become established in Broadland and along the River Waveney before they were colonised from outside. However, the area where mink are most abundant, in the west of the county (Fig. 3), does not correspond to known mink holdings. It is likely that this population has developed from an established population along the River Great Ouse, which may have had its origins well outside the county.

Whatever the origins of mink in Norfolk, the species is now well established and is likely to remain, for better or worse, a member of our fauna for the foreseeable future. It is indeed possible that with the cessation of the intensive coypu trapping operations,

Figure 5. The locations of 17 mink farms in Norfolk. Open circles indicate those present before licensing was introduced in 1962.

which have in the past probably slowed the build up of mink, Norfolk will now see a rapid increase in mink numbers.

References

BAKER, S. J. & CLARKE, C. N. (1988) Cage trapping coypus (*Myocastor coypus*) on baited rafts. *Journal of Applied Ecology*, 25, 41-48. BIRKS, J. D. S. & LINN, I. J. (1982) Studies of home range of the feral mink, *Mustela vison. Symposium of the Zoological Society of London*, 49, 231-257. CLARK, S. P. (1970) Field experience of feral mink in Yorkshire and Lancashire. *Mammal Review*, 1, 41-47. GOSLING, L. M. (1985) Coypus in East Anglia (1970-1985). *Transactions of the Norfolk and Norwich Naturalists Society*, 27, 151-153. GOSLING, L. M. (1989) Extinction to order. *New Scientist*, 121, 44-49. GOSLING, L. M. & BAKER S. J. (1987) Planning and monitoring an attempt to eradicate coypus from Britain. *Symposia of the Zoological Society of London*, 58, 99-113. LEVER, C. (1985) *Naturalized mammals of the world*. Longman, London. NORRIS, J. D. (1967) A campaign against feral coypus (*Myocastor coypus* Molina) in Great Britain. *Journal of Applied Ecology*, 4, 191-199. STEVENSON, J. H. F. (1959) *Mink in Britain*, 3rd edn. Exeter, Pitts. THOMPSON, H. V. (1967) Control of wild mink. *Agriculture*, 74, 114-116. THOMPSON, H. V. (1968) British wild mink. *Annals of Applied Biology*, 81, 345-349. THOMPSON, H.V. (1971) British wild mink. *Agriculture*, 78, 421-425. UNITED KINGDOM PARLIAMENT, (1988) Mink and Coypu. Written answer from Mr. Donald Thompson to Mr. Ron Davies. 8 December 1987. *House of Commons Parliamentary Debates. 124H.C., Deb., 6s., col. 125w.* HMSO.

Rat and Mouse Infestations in Non-Agricultural Premises

C. A. Slater

The distribution and status of the common rat and house mouse in Norfolk are not well documented. Records of these two species in *Norfolk Mammal Reports* for the past 20 years are mainly anecdotal with few systematic observations. It is therefore probable that their distribution and status have been regularly under-recorded. One source of information not commonly utilised by mammal recorders is the rodent control work undertaken by local authorities (in this context the term rodent refers to rats and mice only). Records of rodent control from north-east Norfolk during 1987 are presented and discussed to evaluate their use in determining common rat and house mouse distribution and status.

Local Authority Rodent Control

Local authorities have the legal responsibility to ensure that all land and buildings within

their boundaries are kept free from rats and mice as far as practicable. Most authorities administer this function through their Environmental Health Departments (EHDs) many of which offer a pest control service which will deal with rat infestations free of charge, and in many cases mice infestations as well. Other authorities make charges for mice disinfection and many authorities refer complaints, especially non-domestic requests, to commercial companies as their contractors. An indication of the scale of this activity can be gained from the statistic that in 1985/86 more than 450,000 infestations of rats and mice were treated by local authorities in England and Wales (IEHO 1987).

North Norfolk District Council is one of 7 local authorities administering rodent control in Norfolk since 1974 and was chosen for this study for two main reasons. Firstly the EHD employs its own rodent control workers to deal with both rat and mouse infestations and secondly, it was willing to make its records available for examination. As this initial analysis was mainly concerned with evaluating the usefulness of local authority records rather than attempting a large scale survey, data were selected from one year only (1987) in one administrative sector where one rodent control worker was employed. The study area consisted of approximately one third of the total area administered by North Norfolk District Council (Fig. 1).

On receipt of a complaint of rat or mouse infestations from occupiers of non-agricultural domestic dwellings in NE Norfolk, the EHD provides treatment free of charge. However, where the premises are used partly as dwellings and for business, or solely for commercial purposes, a charge is made. Charging for treatment may cause some occupiers not to seek help from local authorities so these categories were excluded from this study. The number of rateable premises in the study area was obtained from the valuation list and totalled 14,207. Premises categorised as non-agricultural and rated for domestic use only amounted to 11,987 (84.4 per cent) and formed the basis of the study.

Identification

Rodent control workers are trained to distinguish rat from mouse infestations in order to provide appropriate treatment. It can therefore be assumed that rat infestation records in NE Norfolk are reliable indicators of the presence of the common rat as the ship rat has not been recorded in Norfolk for many years. The situation with respect to mouse-infested premises is not so straightforward. Although records reliably indicated the presence of mice they did not identify the species which could be either the house mouse or wood mouse.

Corbet & Southern (1977) describe typical house mouse habitat as associated with human activities and buildings whereas the wood mouse prefers more natural, outdoor habitats. These authors also mention an observation that woodmice will successfully compete with house mice in buildings in the absence of human habitation. Similarly, Meehan (1984) states that wood mice rarely venture into inhabited buildings although they will enter outbuildings in winter. In contrast, recent *Norfolk Mammal Reports* have speculated that wood mice numbers in buildings may be increasing at the expense of house mice. Local authority rodent control methods and records usually do not help our understanding of this situation and mouse infestations cannot be identified to species with any certainty. A field study would be required to determine the relative frequencies of house mouse and wood mouse infestations and the factors influencing their prevalence in buildings.

Notification

It would be very helpful to know to what extent occupiers of non-agricultural domestic-only premises notify rat and mouse infestations to the EHD in NE Norfolk in comparison to actual infestation levels. Many factors could influence the notification rate in a given area e.g. the local authority may not provide a comprehensive pest control service, there

may be a charge, the occupiers may treat infestations themselves or a servicing company may be employed. Unfortunately the notification rate in NE Norfolk in 1987 is not known and cannot be estimated. However, one source of information on notification rates comes from a survey organised by the Ministry of Agriculture, Fisheries and Food (MAFF) between 1976 and 1980 (Rennison & Drummond 1984). This survey was the first to provide a comprehensive picture of rodent problems in non-agricultural premises throughout England and Wales using a random sampling procedure carried out by local authorities.

Figure 1. The distribution and number of rat and mouse infestated non-agricultural domestic-only premises reported in 36 NE Norfolk parishes in 1987. 5 × 5 km squares are shown.

The survey revealed that in rural areas (populations less than 3,000 people) only 58.6 per cent of rat infestations and 41.4 per cent of mouse infestations were reported to local authorities. It would require a similar random sample survey in the study area to obtain comparative figures. If similar levels of notification were operating in the study area in 1987 this would have important implications for distribution and status assessments. As it is the infestation rates reported in NE Norfolk can only be taken to indicate minimum infestation levels for 1987.

Distribution

The 36 parishes in NE Norfolk included in the study area are shown in Fig. 1. These parishes are within, or overlap, 25 adjoining 5 × 5 km squares in the National Grid TG sector. Although the exact address of each confirmed infestation was recorded by the rodent control worker, this initial investigation was restricted to analysis at the parish level. The disadvantage of this was that it enabled very few positive confirmations on the grid system. All parishes had a population of less than 3,000 people except for North Walsham with a population of more than 8,000.

Fig. 1 and Table 1 show the distribution of rat and mouse-infested premises by parishes in the study area. Every parish contained at least one rat-infested premises indicating the widespread distribution of common rats. Only 3 parishes (Honing, Swafield, Scottow) are completely contained in 5 × 5 km squares. If records for several years were plotted by address a reasonably detailed distribution map of common rats associated with buildings should emerge.

Rodent control workers also record the site of an infestation and this was used to determine the proportion of infestations inside a dwelling or outbuilding and those outside. The majority, 75.1 per cent of rat-infested premises (excluding the few premises simultaneously infested by both species) were confined to outdoor areas.

Twenty six (72.7 per cent) parishes had at least one mouse-infested premises indicating distribution was not as widespread as rats. Plotting a distribution map for house mouse-infested premises would not be possible without first confirming the identity of the species in each case. If this were done it could add considerably to the distribution map in the 1987 *Norfolk Mammal Report* (p. 164) where the house mouse is recorded in only 3 of the 25 squares in the study area.

The site of mouse infestations were recorded as inside dwellings only or inside outbuildings only. The majority (92.2 per cent) of mouse-infested premises (excluding the few premises simultaneously infested by both species) were within dwellings which was in marked contrast to rats.

Infestation Rates

Rats were reported present in 272 (2.3 per cent) non-agricultural domestic-only premises ranging by parish from 0.8-12.5 per cent (Table 1). Mice were found to be present in 87 (0.7 per cent) premises ranging by parish from 0.2-2.9 per cent. Only 10 (0.08 per cent) premises in 6 (16.6 per cent) parishes were recorded with simultaneous rat and mouse-infested premises ranging from <0.1-0.7 per cent. These figures suggest it is unusual for rat and mouse infestations to be associated and occur in the same premises. Where percentages are given of either rat or mouse-infested premises they include the small percentages that were also infested by the other species.

The higher proportion of rat-infested premises may reflect infestation levels or be biased by other factors influencing notification e.g. more occupiers may undertake their own treatment of mice than rats. Thus these figures can only be used to indicate minimum infestation levels. Average infestation rates in non-agricultural domestic-only premises in rural areas in England and Wales from 1976-1980 were 5.2 per cent for rats and 3.7 per cent for mice (Rennison & Drummond 1984). These figures are much higher than those in the present study and probably reflect the greater value of an unbiased random sample. Also random sampling allows greater confidence to be placed in the significance of annual changes of prevalence. Annual notification rates can at best only provide a rough idea of infestation levels and changes (Rennison & Drummond 1984).

Rats and Mice in Other Locations

Rat and mouse infestations are of course found in locations other than non-agricultural

Table 1. Rat and mouse infestation rates of non-agricultural domestic-only premises reported in 36 NE Norfolk parishes in 1987.

Parish[1]	No. of Ratable Premises	Rat Infested[2]		Mouse Infested[2]		Rat & Mouse Infested[3]	
		No.	%	No.	%	No.	%
Ashmanaugh	58	4	6.9	0	0.0	0	0.0
Bacton	545	26	4.8	12	2.2	4	0.7
Barton Turf	175	5	2.9	2	1.1	0	0.0
Brumstead	8	1	12.5	0	0.0	0	0.0
Catfield	223	6	2.7	3	1.3	1	0.5
Dilham	113	3	2.7	1	0.9	0	0.0
East Ruston	139	6	4.3	1	0.7	0	0.0
Felmingham	150	7	4.7	2	1.3	1	0.7
Happisburgh	613	32	5.2	5	0.8	0	0.0
Hickling	337	5	1.5	2	0.6	1	0.3
Honing	78	2	2.6	0	0.0	0	0.0
Horning	470	4	0.9	1	0.2	0	0.0
Horsey	29	1	3.4	0	0.0	0	0.0
Hoveton	754	16	2.1	5	0.7	0	0.0
Ingham	112	4	3.6	2	1.8	0	0.0
Knapton	130	1	0.8	0	0.0	0	0.0
Lessingham	344	6	1.7	3	0.9	1	0.3
Ludham	464	6	1.3	3	0.6	1	0.2
Neatishead	191	4	2.1	4	2.1	0	0.0
North Walsham	3158	32	1.0	12	0.4	1	<0.1
Paston	64	1	1.6	0	0.0	0	0.0
Potter Heigham	365	8	2.2	2	0.5	0	0.0
Scottow	69	2	2.9	1	1.4	0	0.0
Sea Palling	202	7	3.5	2	1.0	0	0.0
Skeyton	55	2	3.6	0	0.0	0	0.0
Sloley	81	8	9.9	0	0.0	0	0.0
Smallburgh	131	3	2.3	1	0.8	0	0.0
Stalham	1288	10	0.8	5	0.4	0	0.0
Sutton	553	17	3.1	2	0.4	0	0.0
Swafield	92	4	4.3	0	0.0	0	0.0
Swanton Abbott	107	2	1.9	2	1.9	0	0.0
Trunch	331	9	2.7	3	0.9	0	0.0
Tunstead	176	10	5.7	4	2.3	0	0.0
Westwick	34	2	5.9	1	2.9	0	0.0
Witton	93	4	4.3	0	0.0	0	0.0
Worstead	255	12	4.7	6	2.4	0	0.0
Totals	11987	272		87		10	

[1]All parishes had a population of less than 3000 people except North Walsham
[2]Includes premises simultaneously infested by both species.
[3]Premises simultaneously infested by both species.

domestic-only premises and in some cases information on infestations may be available. For instance in the NE Norfolk study area 10.9 per cent of rateable properties were categorised as non-agricultural domestic and business use or commercial use only. If a local authority keeps records for these types of properties they can add to the overall picture. It is of interest that in the national survey rat and mouse infestation rates in both these types of premises in rural areas were much higher than in domestic-only premises and the notification rates were lower (Rennison & Drummond 1984).

Rats are often associated with sewers, agricultural holdings and refuse tips and in favourable conditions large numbers can build up at these locations. Little information seems to be available on prevalence at these sites locally although information collected nationally between 1973 and 1975 indicated that about 60 per cent of sewers and 50 per cent of groups of farm buildings were infested by rats (MAFF 1976).

Conclusion

Local authorities providing a rodent control service can be a useful source of information on rat and mouse distribution and status in non-agricultural premises in their areas. Rat infestation records enabled positive identification of common rats in NE Norfolk but mouse infestation records did not allow house mouse and wood mouse infestations to be distinguished. Notification rates are probably low in some areas and this must be taken into account when interpreting data. The distribution of rat and mouse infestations could be plotted from address records but assessing status and trends is limited to determining minimum infestation levels in a given period. Positive identification of house mouse or wood mouse infestations and random sampling could make a significant contribution to existing mammal records. However, this would require much more effort on the part of the investigator compared to only examining local authority rodent control records.

References

CORBET, G. B. & SOUTHERN, H. N. (eds) (1977). The Handbook of British Mammals. Oxford: Blackwell Scientific Publications. IEHO (1987) Environmental Health Report 1985-1986. Institution of Environmental Health Officers, Chadwick House, Rushworth Street, London, SE1 0QT. MAFF (1976). Rodent Infestation in England and Wales — July to December 1975. Technical Circular No. 34, Sept 1976. Ministry of Agriculture, Fisheries and Food: Agricultural Development and Advisory Service, Pest Infestation Control Laboratory, Hook Rise South, Tolworth, Surbiton, Surrey, KT6 7NF. MEEHAN, A. P. (1984). Rats and Mice. Their Biology and Control. East Grinstead: Rentokil Laboratories. RENNISON, B. D. & DRUMMOND, D. C., (1984). Monitoring and Improving Rodent Control Progress in Non-Agricultural Premises in England and Wales. Environmental Health 92 (11): 287-297.

Acknowledgents: The North Norfolk District Councils' Environmental Health Department kindly allowed me to examine their rodent control records. I am most grateful to Maurice C. Duffield, Principal Environmental Health Officer, North Norfolk District Council, for his valuable help in obtaining and collating data in NE Norfolk.

Norfolk Bat Review 1988-1989

J. G. Goldsmith

Pipistrelles still account for well over 90% of all bats encountered. Their fondness for human habitation means that the summer colonies of mums and babies are often detected by the droppings that can accumulate beneath the entrance holes. Almost 300 enquiries were handled by Norfolk Bat Group volunteers and the Nature Conservancy Council during the 1988/89 period, the majority of which concerned Pipistrelle colonies. A most encouraging trend these days is that very few householders who find they have bats as house-guests during the summer, demand their immediate exclusion. Often they become proud colony 'owners', so that 'counting the colony' becomes a focal point for a garden party/barbecue! Summer eviction is not of course usually a humane practical possibility, even without the restraints of the 1981 Wildlife & Countryside Act!

Noctules remain noteworthy, with breeding tree roosts recorded at Norwich, Woodbastwick and Thorpe. The latter colony unfortunately resided in a felled Sweet Chestnut tree. The tree, dislodged by the October 1987 gales and leaning at seventy five degrees on a fellow Oak, had been checked by the tree felling gang since it contained holes, but when actually sawn-down on 30th June 1988 over 120 adult and juvenile Noctules appeared as the trunk split open during its sliding descent to the ground. An emergency visit was arranged within half an hour and the trunk carefully dismembered. All the bats — mostly juveniles — were caught up and the colony was placed in a large specially constructed bat-box, on an adjacent tree, just before dusk. The scene at sunset was very spectacular with many criss-crossing Noctules weaving at low level between the trees and others on the ground, some crawling over the now prostrate trunk, searching for their lost babies. Even before the box full of youngsters could be affixed to the tree, mothers were alighting on it and communicating with their offspring. Some of the smaller babies were taken by their mothers from the box to another, unknown, roost but the box remained in occasional use for about two weeks. Only three skeletons were found in the box at the year end, indicating a reasonably successful 'rescue'. Our other large bat, the Serotine, was found at new sites in 1988: Loddon, Winterton, Feltwell and unconfirmed at Burnham Overy.

Visitors to the known underground hibernation sites were tackled by about half-a-dozen licenced people. Daubenton's, Natterer's and Long-eared bats were seen, although numbers were down overall, probably due to the two successive mild winters. Brants and Whiskered bats, both usually only encountered underground in winter, are now a great rarity in the county, with only a single specimen of the former species noted. Work on protecting and enhancing selected underground sites continues, with the 'best' Norfolk hibernation site — chalk caves in the Stanford Battle Area — having over 60 individual bats of five species recorded.

Lastly our East Anglian speciality, the Barbastelle, was noted in North Norfolk (with one not previously recorded at Stiffkey in May 1985) and the exciting discovery of what seems to be the only currently known breeding colony in Britain: in a picturesque old black weather-boarded cart-shed near Cromer in July 1988.'

NORFOLK & NORWICH NATURALISTS SOCIETY (Reg. Charity No. 291604)

Patron: Her Majesty the Queen Founded in 1869

The County's senior natural history society. It has for its principal objectives the practical study of natural science, the conservation of wild life, the publication of papers on natural history, especially those related to the county of Norfolk, arranging lectures and meetings and the promotion of active fieldwork. Specialist Groups cover most aspects of the county's flora and fauna.

Annual Subscription Rates:
Junior £3.00
Ordinary £8.00
Family £10.00
Affiliation £15.00

Publications:
May: Transactions
August: Bird & Mammal Report
Quarterly newsletter 'Natterjack'

Secretary:
A. L. Bull
Hillcrest
East Tuddenham
Dereham NR20 3JJ

Membership Secretary:
C. R. Dack
12 Shipdham Road
Toftwood
Dereham NR19 1JJ.

NORFOLK ORNITHOLOGISTS ASSOCIATION (Reg. Charity No. 267670)

for Birds and Bird-watchers

The N.O.A. was established in 1970 to act as a parent body to Holme Bird Observatory (est. 1962), to further knowledge of ornithology, especially migration, to conserve habitats and disseminate knowledge of natural history through its wardens and reports.

Our Reserves are:

Holme Bird Observatory
By agreement & Purchase. Full-time Warden. 300 species seen in area 386 species of moths recorded.

Walsey Hills Information Centre & Migration Watch Point
Originally est. 1949. Purchased 1973. A vital migration watch-point. Seasonal Warden.

Holme Marsh Bird Reserve
Est. 1976. By agreement. 90 acres of relict grazing for waders & wildfowl. Part-time & voluntary wardening.

The Quags, Kelling
A 14 acre rough grazing marsh with pool purchased 1984. Passage and resident waders.

Redwell Marsh, Holme
A 35 acre wetland pasture purchased 1985.

Annual Subscription rates:
Individual £8.00
Husband/wife £11.00
Family £12.00
Junior £4.00
Single Life Membership £125.00

Members receive: free permits to our reserves, free N.O.A. Annual Report (pub. March), free Norfolk Bird & Mammal Report (pub. Aug.) and 2 News Bulletins.
Address: Norfolk Ornithologists Association (Office), Aslack Way, Holme next Sea, Hunstanton, Norfolk PE36 6LP.

Printed in England by Witley Press Ltd , Hunstanton, Norfolk

Riley Dunn & Wilson Ltd